

Flight, March 12, 1910.

FLIGHT

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In the year ? when Paulhan arrives on a Henry Farman aeroplane in London, and calls at the offices of FLIGHT and the AUTO, at 44, St. Martin's Lane, near by St. Martin's Church, Trafalgar Square, the National Gallery, and Coliseum.—
Another FLIGHT "fake."

THE DUTY OF THE PROVINCES.

SIGNS are not lacking that an admirable start has already been made this year in the cause that we all have at heart. The Exhibition at Olympia has just opened under the happiest of auguries, in view not only of Royal Patronage, but hardly less satisfactorily also in view of the substantial all-British commercial support that is now in evidence to a remarkable degree. Similarly, too, an added dignity was bound to pervade the general atmosphere at the Show, in view of the proud position to which the national Club has been enabled to aspire, by virtue of the graciousness of the Sovereign; while last to be mentioned, but far from least in importance from a coldly industrial standpoint, the outlook has been rendered doubly favourable by the pronouncement which was made by Mr. Haldane in the House of Commons on Monday.

Briefly reiterating the upshot of the above-mentioned potent aids to progress, the rapidly growing industry of flight now has the sympathetic support of the highest personage in the land; its importance to the military and naval authorities of the country has at length been publicly acknowledged with no uncertain voice by one of the most prominent Cabinet Ministers of the time; and then, too, as against the mere handful of British firms and experimenters who were in evidence at Olympia a twelvemonth ago, the country can count upon numbers of prominent firms of recognised standing, besides having cognisance of dozens of British attempts by pioneers possessing originality as well as all other attributes to enterprise.

But, admirable in every way as it is to know that such official progress is in store, as, for instance, the formation of a regular Aeronautic Corps by the War Office, and that numerous manufacturing concerns are busily at work, yet it is just as well that readers of this journal should recognise the direction in which they themselves can render extremely valuable service. All the officially conducted experiments in the world, and all the manufacturing preparations that it is possible to provide in the factories throughout the land, are powerless alone to place the practical side of flight on the basis that it must achieve ere the new industry can really claim prosperity. It is those who are to benefit by the existence of machines rendering possible human flight that must teach themselves to acquire the new knowledge and the new instincts which can alone fit them to utilise the aeroplane and the dirigible when these are ready to their hand; and there is no greater mistake than to suppose that mere reading about the exploits of pioneers and of the more enterprising of a small section of the community, will fit the progressive public for the new sport and the new form of locomotion that is shortly to be at their disposal.

Frankly, one of the most serious questions of the day for the leading spirits throughout the entire country to ponder over (and to act upon when any solution has been found), is how best to make it the fashion for the classes and the masses to take up aviation with the same avidity that they take up relatively senseless "rages" such as those connected with personal costume or with pastimes of the roller skating kind. In all the more important centres, clubs are, it is true, rapidly springing up either for facilitating co-operation between prospective owners of full-sized aeroplanes or between those who are almost equally wisely turning their attention to the construction and flying of models. It is little more than a platitude to say that competition is the

one and only certain way by which permanent interest and participation can be assured along any such lines as those. Just as a month or two ago we suggested Flight-Golf as a new game that would tend to this end by popularising the art of flying working models, so now we feel the time is ripe for bringing forward a parallel proposal relating to full-sized flying machines. Briefly outlined, the idea is that as many of the principal towns as possible in the United Kingdom should be urged to subscribe for, and thereby to own, an aeroplane of their own that might be built and tested in as public a manner as possible locally, and then be entered in the name of the town in suitable events at the big aviation meetings that are for some little time to come inevitable fixtures. There are very few towns indeed that do not possess the necessary enthusiasm and talent for enabling everything connected with such a task to be performed locally, and in every case the aero club of the district could be reckoned upon to take the matter up—first of all as regards settling the designs, then as regards obtaining the necessary materials, often for the practical manual work of constructing, and then as custodians and manipulators. Honorary services such as these would not only be their own reward to the principal actors, owing to the personal experience gained in the pursuit of an altogether delightful hobby, but even more important still they would have such an educative influence throughout the vicinity that the way for the aeronautic industry in the near future would effectively be paved without loss of time.

It might, perhaps, be objected that the local clubs themselves ought to find the necessary funds from the pockets of their own members to carry out any such propaganda as that which we are suggesting. Partly there would be an instinctive disinclination on the part of the local leaders of the aeronautic movement to ask for funds from their own friends and fellow townsfolk. We are inclined, however, to emphasise the overwhelming importance from the point of view that we have in mind of permitting the general public to put their hands in their pockets and to obtain a proprietary right in the various machines under construction, and consequently we realise that the initiative in this matter ought perhaps to be taken up and given a start by some national body that could make an impersonal appeal for the funds and thereby act as an independent go-between. Apparently this task would, in view of the mutual agreement now in force between the Royal Aero Club, the Aeronautical Society, and the Aerial League, fall upon the last-mentioned body, and we therefore venture to draw their direct attention to this matter as well as that of all the provincial clubs that are already in existence.

Partly it will be observed that our object is to create a strong amateur element in this country and thereby neutralise to a great extent the professionalism that may well, if we are not careful, jeopardise the success of aviation meetings long before that type of event shall cease to be of value. Chiefly, however, we regard the idea as being a means of interesting as large a circle of the British public as possible in the shortest possible time, thereby winning for the cause the goodwill of everyone, instead of running a risk of having progress jeopardised a few years hence by any anti-flight section of the general public, comparable with the anti-motoring section that has had to be contended with by the automobile.

FLIGHT PIONEERS.



SIR HIRAM S. MAXIM.

THE WRIGHT BIPLANE.

EVERYONE who has followed the history of the development of the Wright biplane is familiar with the fact that it was evolved from a glider of almost identical design although different in actual dimensions. In having very fully described the construction and operation of a Wright glider in FLIGHT, Vol. I, page 568, therefore, we have already covered a great deal of the ground that would otherwise afford subject matter for the present article; in fact, the accompanying remarks and illustrations must largely be regarded as supplementary to the previous description. We publish on the opposite page a plan and elevation of the machine, and there appear herewith three sketches of details that we have not hitherto fully illustrated. One shows the bracing of the rudder, another shows the attachment of the vertical struts to the main spars, and the third illustrates how the radius-rods between the chain-brackets are coupled up to cases containing ball-bearings that ride upon the crank-shaft.

The general construction of the machine is much the same as the glider that we have already described. Each main deck is built up of two transverse spars placed four feet apart and joined at intervals of about twelve inches by specially shaped rib members that project behind the rear spar and form the flexible trailing edge that is such an important feature of these machines. Two points of especial interest about the arrangement of the ribs are that those near the extremities of the spar are curtailed and are also less in camber than those in the centre, and that the two main spars themselves lie at the same level above the ground, so that it is entirely due to the trailing portion of the decks that the chord has any angle of incidence at all.

The flattening and curtailing of the ribs in the vicinity of the extremities of the decks reduces the intensity of the aerodynamic disturbances, and tends thereby to avoid loss of efficiency by reducing the lateral spewing of the air from beneath the decks.

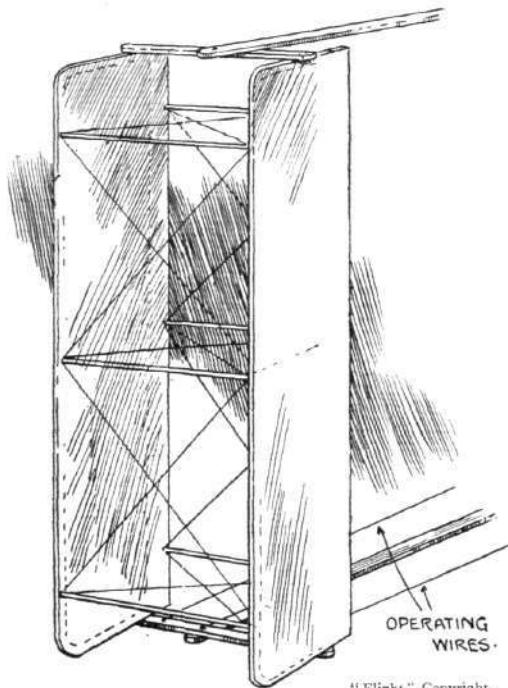
The horizontal position of a chord drawn between the two main spars is of particular interest because it emphasises the practical application of the principle of the dipping front edge. The machine in horizontal flight proceeds through the air with the chord between the two main spars in a horizontal position, consequently the leading edge dips down instead of being tangential to the line of flight.

Lanchester's theory of the dipping front edge—the discovery of which, by the way, is due to Phillips, who describes this peculiarity of a bird's wing in his patent No. 13,768 of 1884—is that an aeroplane in horizontal flight is virtually always falling through the air and is, therefore, always meeting an up-current. This up-current, when compounded with the horizontal motion of the machine, gives to the relative wind an actual obliquely upward trend, and it is to this slope that the leading edge of the aeroplane should be tangential in order that it may receive the air without shock. Having received the air in this way the cambered surface of the aeroplane proceeds to change the upward motion of the air into downward motion, and this is done gradually by the gentle camber of the decks. By the time that the molecules of air have reached the rear spar their direction of motion has been entirely reversed, and this has taken place, it will be seen, without reference to the trailing portions of the decks or to the question of the amount of the angle of incidence represented by the chord between the leading and trailing edges of the complete deck.

By its action of continuously changing the direction of flow of a stream of air, the aeroplane experiences the upward lift that supports it in flight, and according as the engine power is more or less than the exact amount required for horizontal flight so does the machine ascend or glide obliquely to the earth. The thrust of the two propellers (which are driven in opposite directions by chains, one of the chains being crossed), forces the machine through the air, and causes the aerodynamic condition that has been described above.

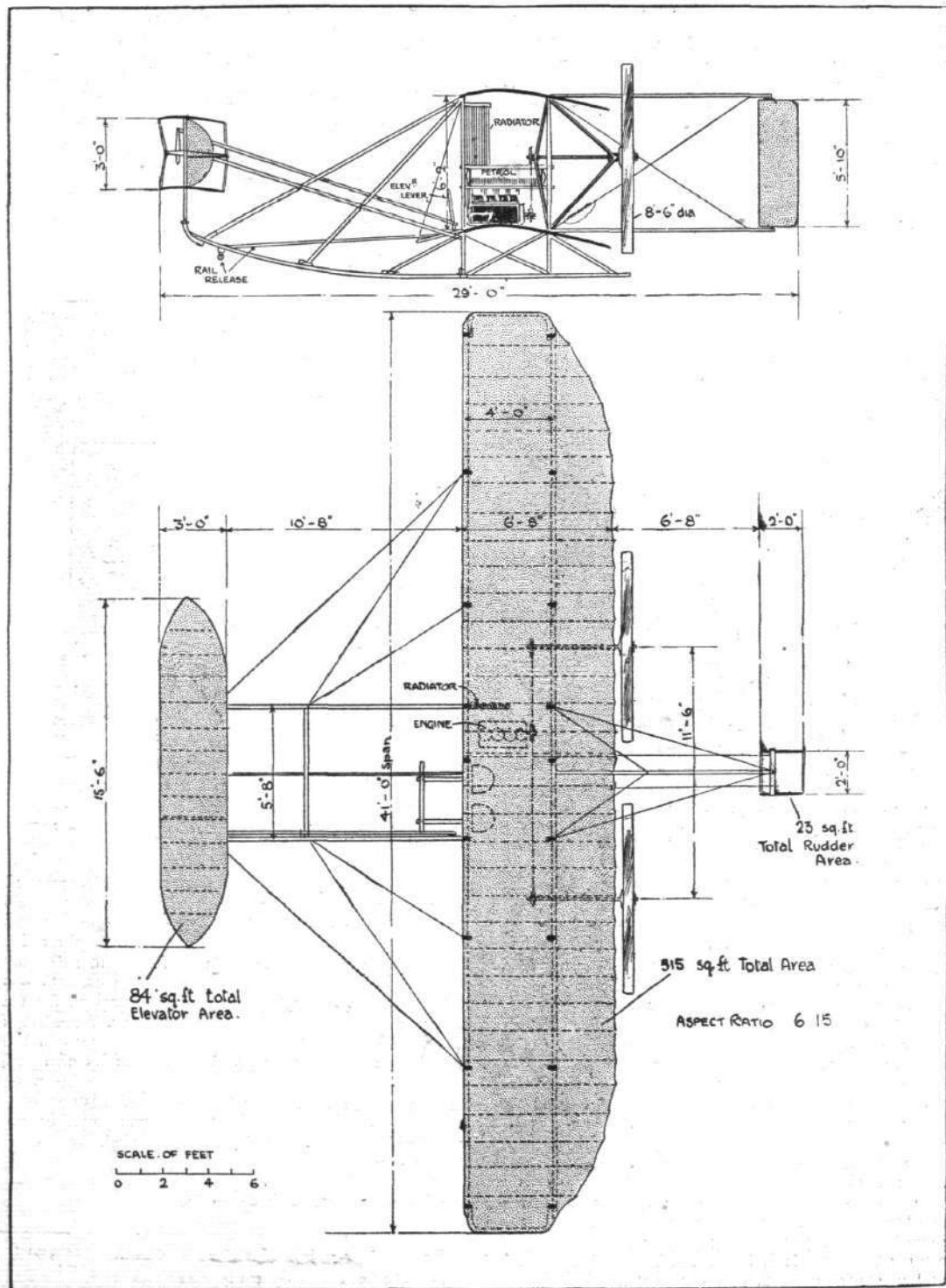
In order to maintain the machine in equilibrium, the pilot is provided with three controls that are operated by two levers, one of which he holds in his right hand while the other he holds in his left hand. The lever held by the pilot's right hand controls a miniature biplane that is mounted on a horizontal transverse axis situated about twelve feet in front of the main decks. This elevator, as it is termed, is carried on a light outrigger framework that also extends beneath the body of the machine and forms the ski or runners wherewith the machine alights upon the ground.

The purpose of the elevator is to assist in maintaining longitudinal equilibrium, and its two decks are so constructed that they can be flexed into a camber that is either concave or convex to the earth as required. When



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Sketch showing the bracing of the rudder on the Wright biplane.

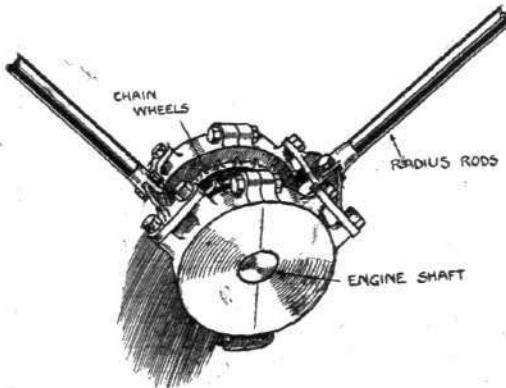
the pilot moves the lever so as to make the camber of the elevator concave to the earth, its aeroplane action, which is the same as that of the main planes already described, is such as to tilt up the front end of the machine. Conversely, if the machine is already tilted up too far, a reversal of the camber serves to restore the horizontal position.



THE WRIGHT BIPLANE.—Side elevation and plan.

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The term elevator that has been applied to this device must not be supposed to suggest that it is capable of lifting the machine as a whole. Its elevating power is sufficient only to tilt the machine either for the purpose of restoring equilibrium or for the purpose of inclining the attitude of flight. Actual ascent can only be effected as the result of developing an excess of power over and above that required for horizontal flight, hence the engine must be considerably larger than considerations of horizontal flight alone demand. Owing to the fact that an aeroplane does not develop the reaction necessary for its support unless it is travelling at a certain speed, it is, unfortunately, impossible to compensate for ascent by travelling more slowly through the air in order to economise power. Ascent automatically results from an increase of velocity through the air, and descent similarly results from a decrease in the velocity through the air, unless provision is made for altering the angle of incidence (*i.e.*, the angle made by the chord to the relative wind), so as in the first place to reduce the lift for a given velocity, or, in the second place, to increase the lift for a given velocity. It would seem that the



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Sketch showing how the radius-rods that form struts between the chain-brackets on the Wright biplane are supported by ball-bearings on the crank-shaft of the engine.

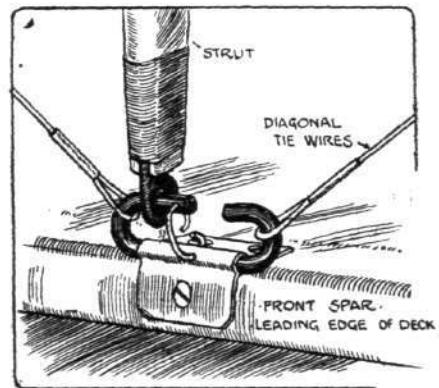
limits within which any such alteration is possible in machines with rigid planes is very limited in amount.

So far, we have considered only the longitudinal stability of the machine as it is determined by the operation of the elevator; an equally important matter is the transverse equilibrium and steering that are under control through the agency of the lever in the pilot's left hand. This lever is mounted on a universal pivot so that it can move sideways, or to and fro. When moved to and fro it operates the rudder at the rear of the machine and steers in the same way as a boat. If moved sideways it causes the extremities of the decks to warp in such a manner that the trailing edge at one end is depressed while that at the other end is raised.

This at once affects the camber of the decks and consequently the angle of incidence, so that, for a given velocity, one side of the machine exerts a greater lifting effect than the other. Should the machine be accidentally canted by a wind gust, warping thus affords a means of restoring balance. It is important, however, to bear in mind in connection with this system that any alteration in the angle of incidence likewise involves an alteration in the resistance of such a character as to make the

machine swerve from its path. This tendency can be neutralised by a suitable use of the rudder, which, as we have explained, is controlled by the same lever, and it is, in fact, the great feature of the Wright control that the warping of the wings and the moving of the rudder can be simultaneously accomplished in this manner.

When steering, the warping and rudder movements are both brought into play. Flying over a curved path causes the outer extremity of the aeroplane to have a higher relative velocity than the inner extremity, and this in turn causes the outer extremity to exert a relatively greater lift so that the machine cant over. A certain amount of canting is obviously advantageous, in the same way that a banked road is advantageous when going round a curve on a motor car, but if the canting becomes excessive the machine might capsize, and in order to check this, the warping of the wings may be brought into action. If thought desirable the warping of the wings may, of course, be employed to give an initial cant to the machine; in fact any combination of rudder and warping movements may be employed as may seem to be best suited to particular requirements.



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Sketch showing how the vertical struts between the main decks of the Wright biplane are attached to the main spars.

The Wright biplane is, as has been described, supported upon a pair of skis. It is not provided with any wheels for running along the ground, and, in order to be launched in flight, it has to be mounted on a light detachable trolley that is constructed to run upon a single rail previously laid down for that purpose. The initial acceleration is obtained by the use of a falling weight dropped from a tower and coupled up to the machine by a rope, but if the conditions are suited to the use of a longer rail, the machine may be started by the thrust of its own propellers alone. The trolley is, of course, left behind when the launching has been accomplished. If it is necessary to push the machine about over the ground another pair of light single wheeled trolleys are employed.

It is sometimes urged by those who take a pessimistic view of the future of aviation that this characteristic of the Wright flyer constitutes a permanent disability in machines of this type, and it should therefore be pointed out that there is no reason why the skis should not be fitted with wheels like the machines of Farman and others. The problem of making a re-ascent from any spot upon which the machine might happen to land as the result of a breakdown during an attempted cross-country flight is

obviously one that is only capable of limited solution at the present time. The main desideratum has been to accomplish flight first and to work out details associated with such questions as re-ascent afterwards. It would trouble even a helicopter (*i.e.*, direct lifting machine) to rise gracefully after a forced descent in the forest, and just as it is commonly difficult to re-float a stranded boat so is it only reasonable to suppose that flying machines may occasionally find themselves in difficulties, if for any reason they are unintentionally displaced from their element. The proper solution lies rather along the lines of reliability than special invention, for this factor, which has most contributed to the practical utility of the motor car, is also most likely, so it seems to us, to contribute to the practical utility of the flying machine.

From a constructional point of view the Wright biplane is of extreme interest, and it may be remarked that its many details have been the subject of most

stringent criticism. For our own part we are inclined to appreciate the design as the embodiment of a remarkable amount of common-sense. One of the leading details of the machine is the method of attachment of the vertical struts, which support the upper deck, to the transverse spars that form the principal members of the decks. This detail forms the subject of an accompanying illustration.

The strut, which, like the rest of the framework, is made of wood, is fitted with a steel eye-piece that is let into a groove and lashed in place as shown in the sketch. The eye-piece fits over a steel hook that is fastened to the spar by a steel plate, and the hook and eye joint thus formed is locked by threading a piece of wire through two holes as shown in the sketch. It is a simple and effective coupling, as it enables the machine to be strained without doing permanent damage, and it also facilitates dismantling the parts.

THE GOVERNMENT AND FLIGHT.

IN the House of Commons on Monday evening, Mr. Haldane, in the course of his speech introducing the Army Estimates, made some important statements concerning the attitude of the Government towards flight. He stated that it had been decided to organise a special Aeronautical Corps, and also that a large dirigible was being designed. We reproduce his remarks in full:—

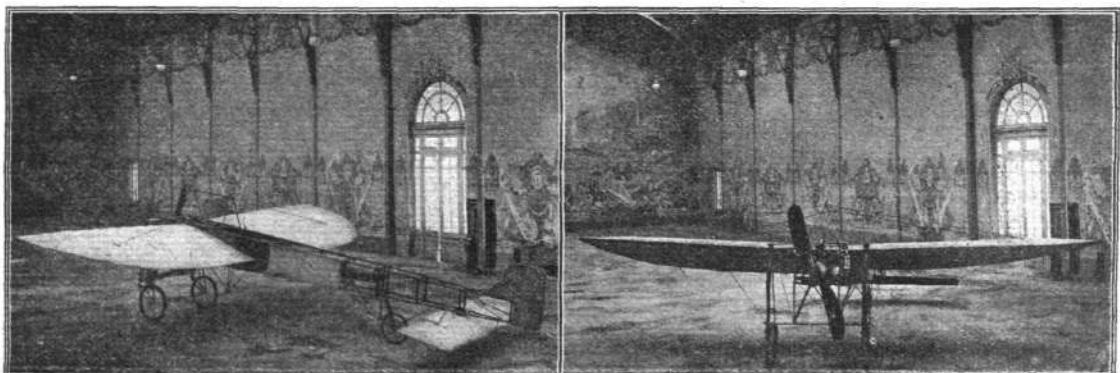
"I want now to say a word about dirigibles and aeronautics. The aeronautical department at the National Physical Laboratory got to work almost at once after it was set up last year, and since then it has been found necessary to increase its staff, and the work at Teddington is in full swing. We have also reorganised the construction department at Aldershot, which used to be under the care of Colonel Capper, who did remarkably good work. We want Colonel Capper's great abilities, however, for the training of officers and men at the balloon school, and for the work which he has hitherto done we have got hold of a man of great capacity and high eminence, Mr. O'Gorman, who is very well known in connection with the construction not only of motor engines, but other subjects connected with motoring.

Mr. O'Gorman has now organised a construction department at Aldershot. The next step we propose to take—and we have already decided on its lines—is to substitute for the present corps a regular aeronautical corps, such as exists in Germany, separate from any other corps in the Army, devoted to aeronautics. The balloon school will become the training school for that corps. I am convinced that until we get everything perfectly clear we shall only make very slow progress. The results of the investigations of the Committee presided over by Lord Rayleigh are now being used for

the designs we are now engaged upon. At present we have one small dirigible at Aldershot, designed by Colonel Capper, which so far has been doing well, and two more are coming from France. There is the "Clement-Bayard," the negotiations for which have been undertaken by the Aeronautical Committee of the House, and if they are satisfactory it is not impossible that the War Office may purchase it. There is also the "Lebaudy," which, through the patriotism of the *Morning Post*, has been offered to us. It is coming over before long. We are also working on designs of a large dirigible of our own, which I hope will be completed, certainly commenced, in the course of the financial year. Then, of course, there is the great naval dirigible, which is rapidly approaching completion, and which, I believe, will be launched in the summer. As soon as we have made ourselves masters of the lessons which these teach we shall go on working at the construction of other dirigibles and shall be in a position of having a fleet. The whole subject is in its infancy. I am never alarmed by reading about the progress of other nations in this respect. Already much of the material possessed by foreign nations is being found to be unsatisfactory, and I have not very much fear that if we put our backs to it we shall find ourselves ahead.

British Naval Dirigible.

IN reply to a question in the House of Commons last week, Mr. McKenna announced that the dirigible which is under construction at Barrow is expected to be completed in June or July next. Until experience had been gained with this dirigible, Mr. McKenna thought it would be premature to erect further garages or sheds on the East Coast or elsewhere.

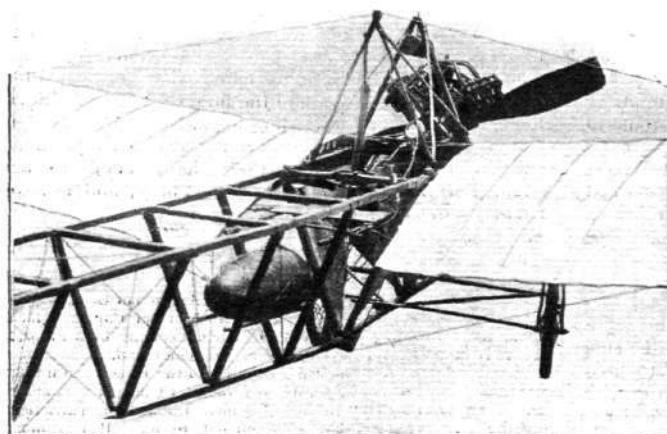


BLÉRIOT'S CROSS-CHANNEL FLYER.—As a souvenir of M. Blériot's historic feat in flying across the Channel, Messrs. Blériot, Ltd., the London manufacturers of the famous lamps designed by M. Blériot, have issued postcards, reproduced above, showing the flyer as it appeared when on exhibition in London afterwards. These can be obtained at the Company's stand at Olympia during the present Show.

THE MACFIE BRITISH AEROPLANE.

(Concluded from page 154.)

THE skid was specially designed for use on the sand over which the first experimental trials were carried out. It is very light and is provided with a combination of elastic and steel springs, as shown in one of the accom-



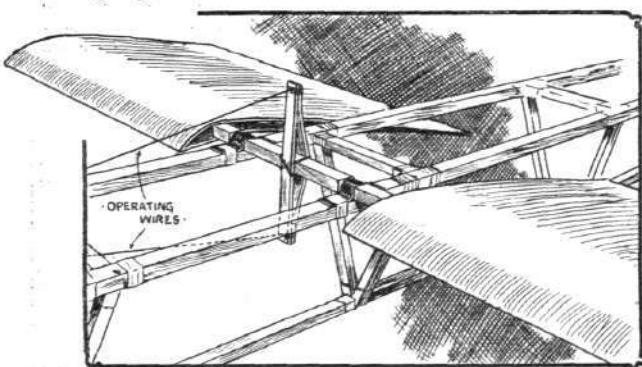
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View of the Macfie monoplane, showing the position of the pilot's seat and the overhead frame used in the trussing of the main wings.

panying sketches. The shoe itself is pivoted to a vertical wood column that is free to rotate in its supporting brackets.

The Wings, Elevator and Rudder.

The wings of the Macfie monoplane have a span of 28 ft. 6 ins., and a chord of 6 ft. 6 ins., which gives an aspect ratio of 4·4. They are set at a dihedral angle and are double surfaced. A feature in connection with their plan form is the removal of their trailing corners for a distance of about 3 ft. from the extremities along the trailing edge.

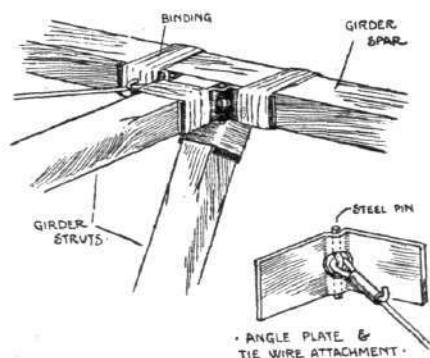


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Sketch showing the mounting of the elevator on the Macfie monoplane.

The surface material, for which Continental fabric No. 100 B has been used, is laid on a skeleton framework consisting of two main spars and a set of shaped ribs in each wing. The main spars are of I-section, those in front

being rigidly bolted to the frame of the machine, while those behind are each so fastened by a single bolt that they possess a certain amount of hinge action, which is employed for purposes of warping. The details of the attachment of the rear spars to the main frame of the machine is shown in one of the accompanying sketches.



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Sketch showing how the joints are made on the Macfie monoplane.

The ribs are spaced along the spars at intervals of about twelve inches, and each rib consists of a built-up member representing the camber of the wing section. The details of this construction are also shown in an accompanying sketch, where the principal dimensions of the rib are given and also the method by which it has been made as light as possible. Further light is also thrown on these details of construction by an accompanying photograph, which



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View showing a portion of the skeleton framework of the elevator on the Macfie monoplane.

shows a portion of the skeleton framework of the elevator tail. There are some differences between the actual details of this member and of the main frame, but the same system is followed in both cases. The ribs, it will

be noticed, project beyond the front spar, and their extremities mortice into a kind of U-section member that forms a rigid leading edge along the front of each wing. The ribs also overlap the rear spar, and in this case form a flexible trailing edge. In the construction of the tail there is no rear spar, properly speaking, but it will be observed from the photograph aforesaid that the ribs are tied together near their extremities by a light lath. Attention should also, perhaps, be drawn to the shape of the main spar in the photograph of the tail framework, as this member has a different section to that employed for the main wings. For its span, a much more massive spar is employed in the tail, owing to the fact that it is so mounted as to be capable of rocking in its supporting brackets, the tail being used as an elevator as is the case on most monoplanes.

In applying the surface fabric, a system is adopted of stretching the material on a kind of former in advance. The former is so constructed that it is possible to transfer the stretched fabric direct to the machine without releasing the tension. This method was, we understand, found to be not only very satisfactory in its result, but also a great time-saver, the surfacing of an aeroplane being commonly one of the longest jobs in its construction



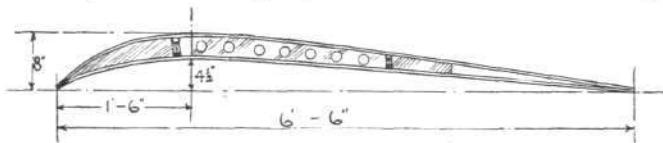
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View of the 35-h.p. 8-cyl. air-cooled Jap engine on the Macfie monoplane.

points in the main spars, over a central triangular framework that projects as a strut above the centre of the machine. In the case of the tie-wire between the rear main spars a pulley wheel is provided for its support on the strut, owing to the movement that takes place when the wings are warped. Details of this attachment are illustrated in one of the accompanying photographs, which shows the position of the pilot's seat.

The rudder is an interesting example of the use of Venesta wood. It consists of two panels, fastened to a light skeleton frame, and each panel consists of three layers of wood, of which the individual thickness is only one twenty-fifth of an inch. This form of construction produces a smooth rigid surface that is not easily

damaged and is reasonably light. It seems particularly suited to a rudder that is as much over-hung in its support as that on the Macfie machine.



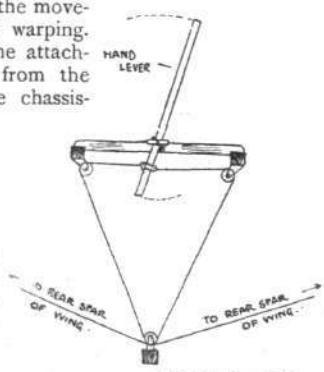
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Sketch showing the construction and dimensions of the ribs employed in the main wings of the Macfie monoplane.

compared with the apparent amount of work that it involves.

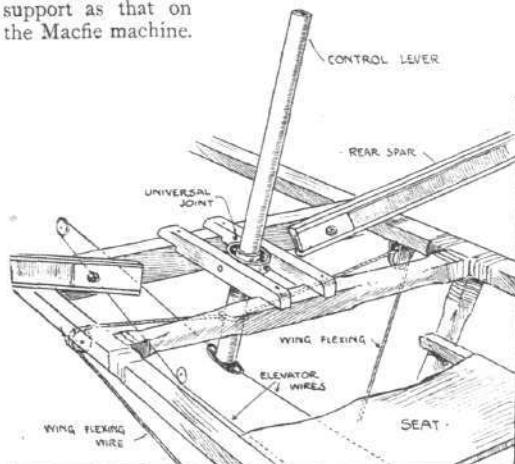
After the surface material has been applied, the wings are braced by the attachment of tie-wires and bars. Flat strip steel is used for bracing the forward main spars to the chassis-frame, but elsewhere steel wire is employed, mainly on account of the movement necessitated by warping. In connection with the attachment of the tie-bars from the forward spars to the chassis-frame, it should be pointed out that these slope backwards as well as upwards from their anchorage, in order, according to the designer, to give the spars additional rigidity in overcoming head resistance.

In addition to the tie-wires beneath the wings, there are others above, which pass between corresponding



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Diagrammatic sketch showing the crossing of the wires employed for warping the wings of the Macfie monoplane.



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Sketch showing the pilot's seat and control lever; also illustrating the hinged attachment of the rear spars of the Macfie monoplane.

The Engine.

The engine installed on the Macfie aeroplane is a 35 h.p. 8-cyl. Jap. The cylinders are arranged V-fashion and are air-cooled. The engine is situated right up in the bows of the frame and is carried on two timber bearers that are rigidly attached to an extension of the main-frame of the machine. The tractor-screw, which is a two-bladed design constructed in solid teak, is mounted direct on the end of the crank-shaft. It has a diameter of 6 ft. 6 ins. and a pitch that is calculated to produce a flight speed of 40 miles an hour at 1,200 r.p.m., after allowing for a 30 per cent. slip. Close inspection of some of the accompanying photographs illustrates an obvious cutting-away of the trailing edge of the propeller, a modification from its original form that was found to result in a considerable improvement in the tractive effort.

The Control.

The control of the Macfie aeroplane is accomplished by means of a universally pivoted lever, and also by the aid of a pivoted foot-rest that serves the purpose of a pedal. The pedal controls the action of the rudder and is independent of all other connections. The lever is mounted vertically and directly in front of the pilot; its position and method of attachment is very clearly illustrated by the accompanying sketch and also by the various photographs. It can be moved in any direction and with either or both hands as the operator may find most convenient. Its lower extremity carries the wires that operate the elevator-tail and near the lower end of

the lever are attached the wires that produce the wing warping. The connections of these latter wires and the manner in which they are "reversed" by the aid of pulleys attached to the main frame, forms the subject of a separate diagrammatic sketch.

This use of a single universally pivoted lever for the double purpose of warping the wings and working the elevator—in a manner that corresponds to the Blériot control—must not be confused with the Wright system, wherein a similar lever is employed for the dual purpose of warping and steering. The arrangement on the Macfie machine is not associated with any particular system of control, it is merely a device for reducing the number of levers that would otherwise be necessary.

On the Macfie machine warping and the manipulation of the elevator can be carried out by the use of a single lever, but this does not imply that there is necessarily any purpose in the interconnection other than that associated with the pilot's convenience.

Moving the lever to and fro operates the elevator, moving it from side to side warps the wings. Warping or the manipulation of the elevator can be accomplished independently with the lever in any position; that is to say, supposing the pilot happens to be holding the lever forward of the neutral position for the purpose of setting the elevator, he can instantly warp the wings by a sideways movement without in any way upsetting the elevator adjustment, and *vice versa*. The manipulation of the rudder, which is commonly necessary in connection with any wing warping operation, is independently accomplished by the use of a pivoted foot-rest to which the rudder is directly connected.



MANCHESTER FLIGHT MODEL SHOW.—General view of the models.

THE AVIS MONOPLANE.

AMONG the new British-built monoplanes at the Aero Show is one exhibited by the Scottish Aeroplane Syndicate. For some time past the first machine of this

pilot depressing the pedal on that side of the machine that is at the lower level, in order to restore equilibrium. Those who have studied modern systems of control will observe that this is, in one sense, the reverse of that commonly adopted inasmuch as those machines that have hand-controlled warping of the wings are so arranged that the lever is pressed over to the right when the right wing is too high and *vice versa*. The machine is driven by a tractor - screw, mounted direct upon the crank - shaft of a 25 - 30 - h.p. Anzani engine.

The machine is mounted upon a pair of long skis, carried upon three groups of struts. A pair of wheels is placed on either side of each ski, the axles being attached by stout rubber in order to absorb the shock of landing. Attention has been paid to the detachability of the former members, and as far as possible provision has been made for easily renewing any that get broken.

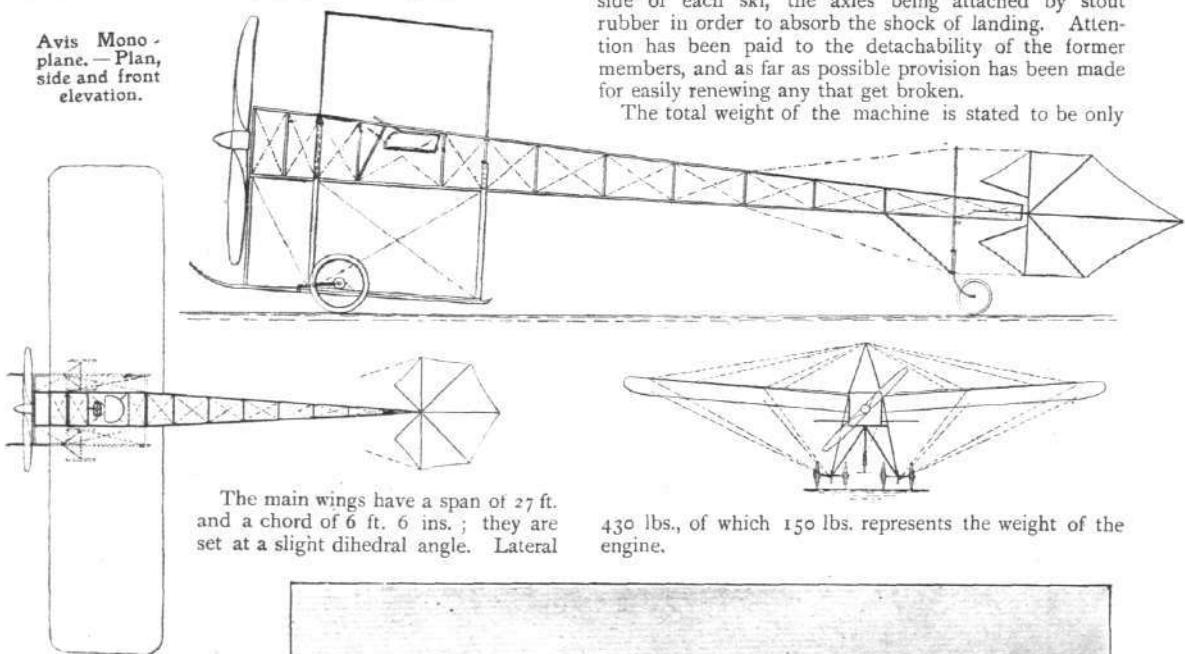
The total weight of the machine is stated to be only



AVIS MONOPLANE.—View from in front.

type has been undergoing practical tests at Brooklands. The machine has a neat, light, and strong appearance.

Avis Mono -
plane.—Plan,
side and front
elevation.

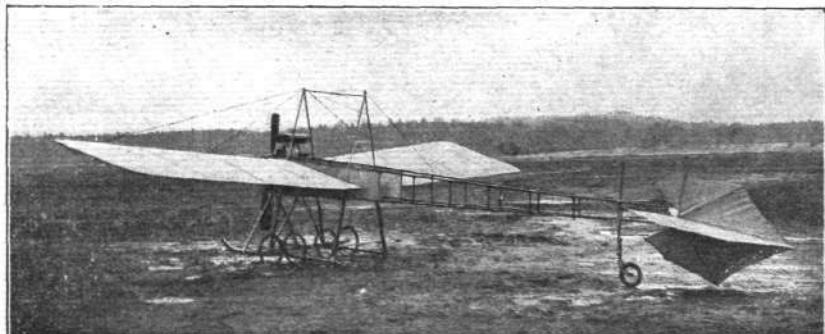


The main wings have a span of 27 ft. and a chord of 6 ft. 6 ins.; they are set at a slight dihedral angle. Lateral

430 lbs., of which 150 lbs. represents the weight of the engine.

stability is obtained by warping, and longitudinal stability by the manipulation of a cross-plane tail similar in design to that used on Santos Dumont's "De-moiselle."

An uncommon feature of the control is that the warping is accomplished by pedals, the



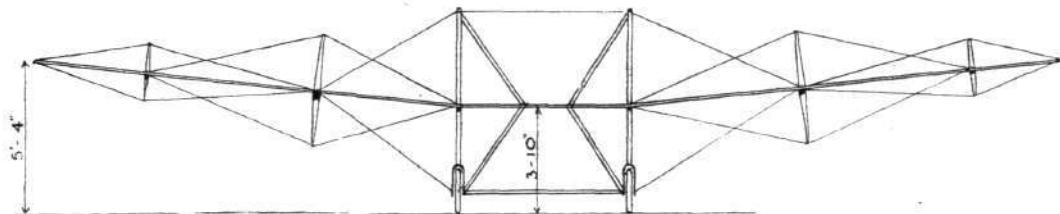
AVIS MONOPLANE.—View from behind.

THE PFITZNER MONOPLANE.

IN our issue of Feb. 26th we published a couple of photographs, together with a few particulars of a monoplane which embodied many unique features, and which had been constructed in the Curtiss factory at Hammondsport, New York, by Mr. A. L. Pfitzner. We are now able to give scale drawings of this machine, and in view of its unique design, and the fact that it has already flown, although only very short distances, we think these further particulars will be welcomed.

Each of the wings of the main plane is made in three sections, each 5 ft. long, which are attached and connected

The system of control, which is shown clearly in our diagram, is a combined one in which all the necessary movements are connected to the one wheel and column. The elevating plane, which is in front of the machine, is operated by giving the steering column a movement to or from the body of the operator; while steering to right and left, by means of the vertical rudder placed above the elevator, is effected by twisting the steering-column wheel; and lateral stability is maintained by turning the wheel. This being connected by cables to the balancing tips causes one of them to project further out



Front view, showing the trussing of the wings, of the Pfitzner monoplane.

by steel sockets and steel cable, the latter forming a symmetrical double king truss with the beams, the king posts being at the junction of the detachable sections. The two wings are set at a dihedral angle of 5 deg. The surface is single, with the framework exposed on the under side, and consists of vulcanized Japanese silk material which is stretched over the ribs by lacing at the junction of each of the seven sections. The curvature of the surface is of the high-speed type, with the centre of pressure 18 in. from the leading edge. The ribs have a camber of $3\frac{1}{2}$ in. in a 6 ft. length, the highest part of the

and the opposite one to be withdrawn a corresponding amount. By the side of the controlling column is a lever connected to the throttle of the motor, while a switch button on the steering-wheel enables the Bosch high-tension magneto-ignition to be switched off for the purpose of stopping the motor. The motor is a 25-h.p. 4-cyl. Curtiss, and drives a 6 ft. spruce propeller of $4\frac{1}{2}$ ft. pitch, giving 235 lbs. thrust at 1,200 r.p.m. It is said to weigh only $6\frac{3}{4}$ lbs.

A noticeable departure from usual monoplane design is the placing of the propeller and engine behind the

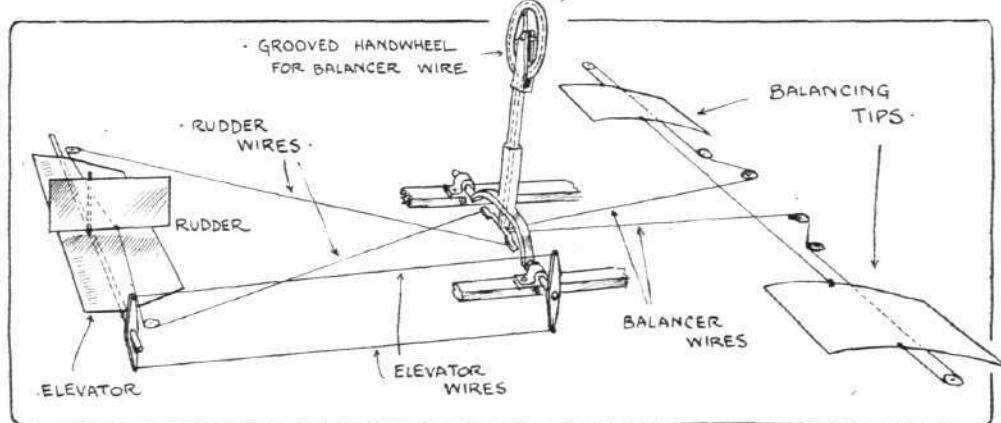
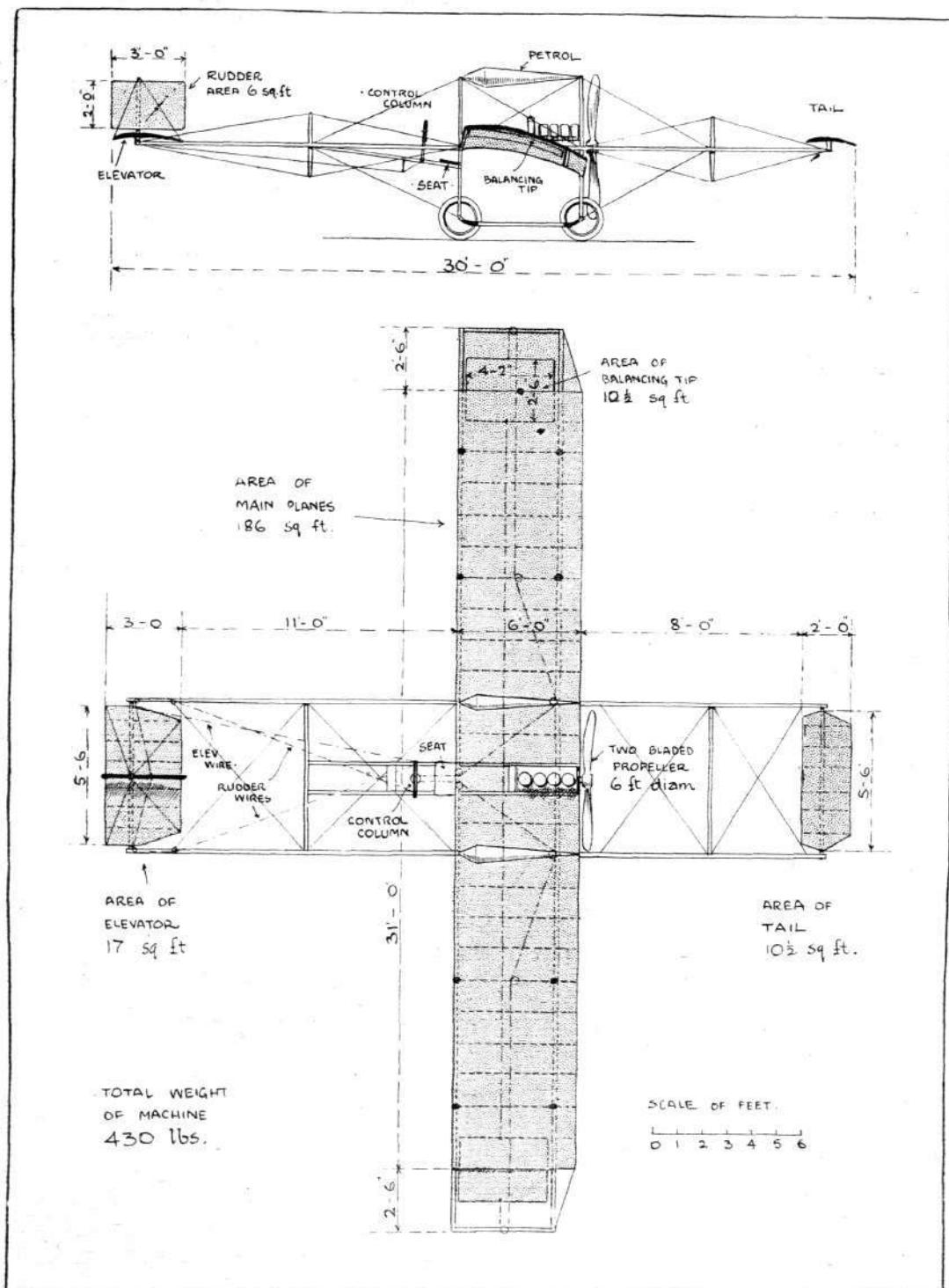


Diagram of the controlling arrangements on the Pfitzner monoplane.

surface being $1\frac{1}{2}$ in. above the leading edge, while the angle of incidence is 8 deg.

The unique feature of the monoplane is the system of equalisers at the tips of the main planes. The main surface, as will be seen from the plan, stops short 30 ins. from the end of each wing, and in this space slides a panel 30 ins. wide by 50 ins. deep, of the same curvature as the main surface. These two balancing tips are inter-connected to the hand wheel, and normally they project 15 ins. at each end.

operator. The design of the chassis, too, is also unusual. It will be noticed that four wheels are employed, and the machine so balanced as to enable it to start in any direction. The chassis is built up of four vertical posts, each forked at the bottom, and holding a 20 in. diameter wheel fitted with a pneumatic tyre. These four posts are spaced by seamless steel tubing, while at the bottom there is a wooden skid which takes the strain after the first shock has been absorbed by the wheels.



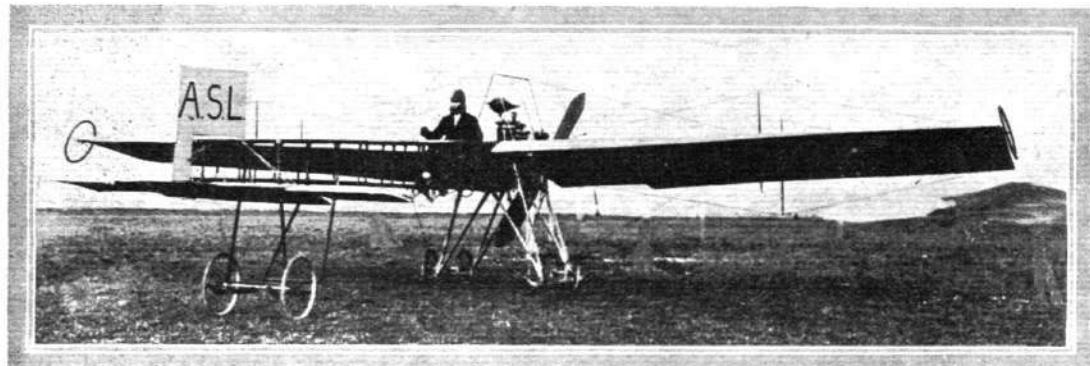
THE PFIZNER MONOPLANE.—Side elevation and plan.

A NEW ALL-BRITISH AEROPLANE.

THE "A.S.L." MONOPLANE.

VERY quietly, but with much determination to succeed, the "Aeronautical Syndicate" have, during the past year, been carrying out experiments in Wiltshire with a monoplane of their own design, and finally, after many trials,

of leaving the pilot with an unobstructed view, and free from the annoyance of the exhaust. The pilot's seat is approximately in line with the leading edge of the wings.



The new A.S.L. all-British Monoplane undergoing its trials in Wiltshire.

they recently achieved their first flight of several hundred yards.

Their machine, as the accompanying illustrations show, is peculiar in flying "tail first," in which respect it may be said to resemble the famous Santos-Dumont aeroplane that won the first flight prize in history. The A.S.L. machine, however, is a monoplane, whereas that used by Santos-Dumont was a biplane. Unlike the majority of modern monoplanes this machine has a propeller behind the main planes, which arrangement possesses the advan-

The wings have a span of 42 ft. and form a slight dihedral angle, the upward slope being 1 in 25. From the accompanying photograph it might be supposed that they were very similar to those employed on the Antoinette monoplane, but, as a matter of fact, they have quite a different camber, the maximum versine in the wings of the A.S.L. machine being much closer to the leading edge than in the Antoinette flyer. In plan, the wings taper towards the extremities, the chord being 10 ft. at the shoulder and 6 ft. at the tips. The fabric,



A close view of the A.S.L. Monoplane, showing the chassis and part of the main frame. The wings have a maximum thickness of 8 ins. at the root.

which is Pegamoid aerocloth, is stretched on to a series of shaped ribs that are fastened to a pair of main spars. The spars are trussed by centre posts and diagonal wires. The rear spar is pivoted to the frame in order to facilitate the warping of the wings.

The overall length of the machine is 31 ft., and in front is fixed a small aeroplane having an area of 18 sq. ft. (6 ft. by 3 ft.). On either side of this fixed plane is a pivoted elevating plane measuring 9 sq. ft. in area (3 ft. by 3 ft.). Immediately above the fixed central plane is a vertical rudder. The horizontal planes are, it will be noticed, mounted below the framework of the machine, the rudder being above.

The machine as a whole is supported on a chassis of "A" formation, the lower members of which consist of a pair of skis provided with wheels attached thereto by an elastic suspension, on the Farman principle. The fore

part of the machine is also independently supported by a light wheeled chassis.

The machine is driven by a two-bladed propeller that is direct coupled to the crank-shaft of a 60-h.p. Green engine. The propeller has a diameter of 8 ft. 2 in., and an actual pitch of 2 ft. Including the engine, the machine weighs 802 lbs., or less than 2½ lbs. per sq. ft. of supporting surface, the wings being 310 sq. ft. in area.

On the ground the angle of incidence made by the chord of the wings to the horizontal is 9°. The angle of incidence of the leading plane is greater than this by an amount that is determined by practical experiment. The designers look forward to extended trials of this type of machine to demonstrate that it possesses a very considerable amount of longitudinal stability, there being much evidence already to show that the principle of the leading plane is associated with this quality.



The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

Committee Meeting.

A meeting of the Committee was held on Tuesday, the 8th inst., when there were present:—Mr. R. W. Wallace, K.C., in the chair, Mr. Ernest C. Bucknall, Vice-Admiral Sir Charles Campbell, K.C.M.G., C.B., D.S.O., Mr. Martin Dale, Professor A. K. Huntington, Mr. J. T. C. Moore-Brabazon, Mr. C. F. Pollock, Hon. C. S. Rolls, Mr. Stapley Spooner, and joint secretaries, Capt. E. Claremont, R.N., and Harold E. Perrin.

New Members.—The following new members were elected:—

D'Arcy Baker. Cumberland Lowndes.
Lewis Evans, M.I.N.A., W. E. de B. Whittaker.
M. I. Mch. E. Harold Whiteman Woodall.

Pilot-Aviators' Certificates.

The Committee, at their meeting on the 8th inst., granted pilot-aviators' certificates to Mr. J. T. C. Moore-Brabazon and the Hon. C. S. Rolls.

Aero Exhibition at Olympia.

The Aero Exhibition at Olympia, held by the Society of Motor Manufacturers under the auspices of the Royal Aero Club of the United Kingdom, opened on Friday, the 11th March, terminating on Saturday, the 19th. Members of the Royal Aero Club will be admitted free on production of their membership cards. A room in the Princes Gallery will be placed at the disposal of the members during the Exhibition.

The exhibit of the Royal Aero Club includes the machine of Mr. J. T. C. Moore-Brabazon, with which he won the circular mile flight prize of £1,000; a Wright machine, on which the Hon. C. S. Rolls has made many flights; a monoplane, the property of Mr. B. Nicholson; and a French biplane, recently acquired by the Hon. C. S. Rolls.

British Empire Michelin Cup.

Members are reminded that the competition for the British Empire Michelin Cup for the first year closes on 31st March, 1910.

The rules are as follows:—

The Michelin Tyre Co. has presented to the Royal Aero Club of the United Kingdom, for competition by British aviators, a trophy of the total value of £500.

Annually, for five years, a replica of this trophy, together with a sum of £500 in cash, will be given to the successful competitor. This trophy will be competed for under the following conditions, which shall apply for the first year only:—

Conditions.—1. The holder of the cup for 1909 will be the competitor who, on March 31st, 1910, shall have accomplished the greatest distance on any heavier-than-air machine without touching the ground.

2. The minimum distance to be covered in order to qualify for

this prize shall be 5 miles round two or more posts for the necessary number of circuits.

3. Entries must be made in writing to the Secretaries of the Royal Aero Club, 166, Piccadilly, London, W. At least two clear days' notice must be given by a competitor before making his attempt.

4. An entrance fee of 10s. will be charged, and a further sum of £1 must accompany every notification of an attempt by any competitor under these rules. Every competitor must be a member of some recognised body dealing with aerial matters in the Empire, and shall, if called upon, satisfy the officials of the Royal Aero Club of his ability to fly at least 500 yards, before making any attempt under these rules.

5. All attempts must be made between the hours of sunrise and sunset, in the presence of the official or officials appointed by the Committee of the Royal Aero Club.

6. The recognised flying ground is at Shellbeach, Island of Sheppey, but the Committee of the Royal Aero Club will be willing to entertain any other ground subject to the competitor paying the necessary expenses incurred.

7. The start for the records will be reckoned from the crossing over the starting line in actual flight.

8. Competitors must be British subjects from any part of the Empire, manipulating a British-made machine. All the principal parts of a competing machine must be British made. All decisions applying to this rule shall be given by the Chairman of the Royal Aero Club, Mr. Roger W. Wallace, K.C., and failing him, by an arbitrator nominated by the President of the Institution of Civil Engineers. This shall not be held to apply to raw material, but all finished or manufactured parts of such machine must comply with the above condition.

9. The decision of the officials of the Royal Aero Club on all matters connected with this competition to be final and without appeal.

Eastchurch Flying Ground.

Railway Arrangements.—The following reduced fares have been arranged with the railway company for members visiting Eastchurch:—

1st Class return, 8s.; 2nd Class return, 6s. 6d.; 3rd Class return, 5s.

Tickets available for one month from date of issue.

Members desiring to avail themselves of these reduced fares are required to produce vouchers at the booking offices. Vouchers can be obtained from the Secretaries of the Royal Aero Club. Trains leave Victoria, Holborn, or St. Paul's.

For the convenience of Members, the best train is the 9.45 a.m. from Victoria, arriving at Queenborough 10.55. At Queenborough change to the Sheppey Light Railway for Eastchurch, which is ½-mile from the flying ground.

BRITISH FLIGHT ENGINES.

"THE GREEN."

Leading Particulars.

30-35-h.p. Type.

Cylinders.—Bore, 105 mm.; stroke, 120 mm.*Weight.*—150 lbs. This is the weight of engine with all pipes, carburettor, and connections, but without fly-wheel or ignition.

Weight of fly-wheel = 23½ lbs.

Weight of ignition = according to type; usually 14 lbs, to 19 lbs.

Power.—30-h.p. at 1,100 r.p.m.; 35-h.p. at 1,160 r.p.m.; 40-h.p. at 1,220 r.p.m. (N.B.—No guarantee of 40-h.p. for very long periods.) *Petrol.*—6 pint per horse-power per hour.*Extreme length.*—39 ins.; *height.*—28 ins.; *width.*—16 ins.

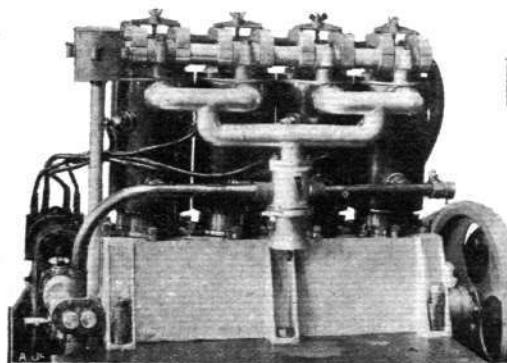
50-60-h.p. Type.

Cylinders.—Bore, 140 mm.; stroke, 146 mm.*Weight.*—250 lbs. This is the weight of engine with all pipes, carburettor and connections, but without fly-wheel or ignition.

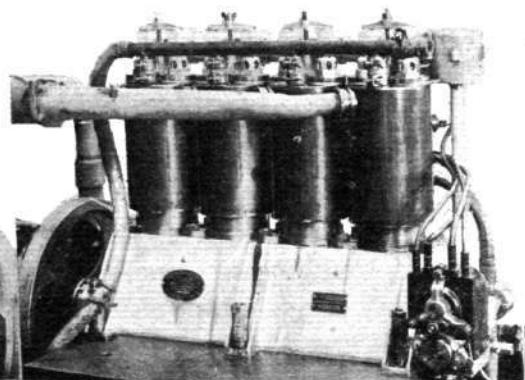
Weight of fly-wheel = 37 lbs.

Power.—50-h.p. at 1,050 r.p.m.; 60-h.p. at 1,100 r.p.m.;70-h.p. at 1,200 r.p.m. (N.B.—No guarantee of 70-h.p. for long periods.) *Petrol.*—6 pint per horse-power.*Extreme length.*—44 ins.; *height.*—3½ ins.; *width.*—17 ins.

WHATEVER may have been the justification for the impression that English designers were slavishly copying Continental practice in the matter of motor car engines—which was current in the early days of motoring—we can



arrangement being to allow them to expand and contract freely without cracking. Even the cylinders themselves are *desaxé* to the crank-shaft, that is to say, they are offset to one side a little so that the crank has passed beyond



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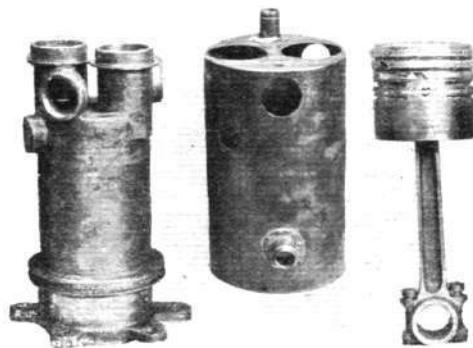
Fig. 1.—Two general views of the Green engine on its test bench.

at least put in a genuine claim for originality on behalf of the British manufacturers of motors that are used for aviation. Even in the case of the very successful Green engine that retains the orthodox characteristic of possessing four vertical cylinders, the design of detail is altogether out of the ordinary; indeed, for an engine of this type it is surprising to find how much there is that differs from accepted practice as represented by the design of other engines of the same type that had become standardised, so to speak, in connection with the automobile.

Like every other manufacturer of motors for aeroplanes and dirigibles, Mr. Green has made low weight per unit of power an important factor in design, but he has not made it the *ruling* factor, nor has he allowed the quality of lightness to jeopardise strength or reliability. Reduction in weight he has considered to be properly within the realm of design rather than mere ingenuity. The Green engine is an internal-combustion motor that operates on the four-stroke cycle and possesses all the parts and accessory fittings that are commonly to be found in modern motor car engines; the only difference is that these same parts are quite frequently dissimilar to those used on a car engine and more often than not are to be found in a different position.

The valves, for instance, are upright in the top of the cylinders and the cam-shaft that operates them lies overhead. The water-jackets are made of copper and are only rigidly fastened to the cylinders at the top, the object of this

its upper dead centre by the time that the piston is at the upper end of its stroke and is receiving the full force of the explosion. Although these are perhaps the most striking features of the Green engine, many of the more



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Fig. 2.—The Green cylinder, showing the copper water-jacket separately. Alongside, on the right, is a piston with its connecting-rod.

minute details are equally interesting, and should certainly be understood by anyone who is "going in" for aviation seriously and contemplates taking more than a mere superficial concern in the details of his machine. These

other constructional features we purpose describing by the aid of the very complete set of photographs and drawings that accompany this article.

The Cylinders.

The cylinders of the Green engine (Fig. 2) are separate steel castings, cylindrical in shape, and closed at their upper ends, except for the passages formed by two chimney-like extensions that enclose the valves. Near the top of the cylinder is a small lateral extension that provides a fitting for the ignition-plug. The valve-

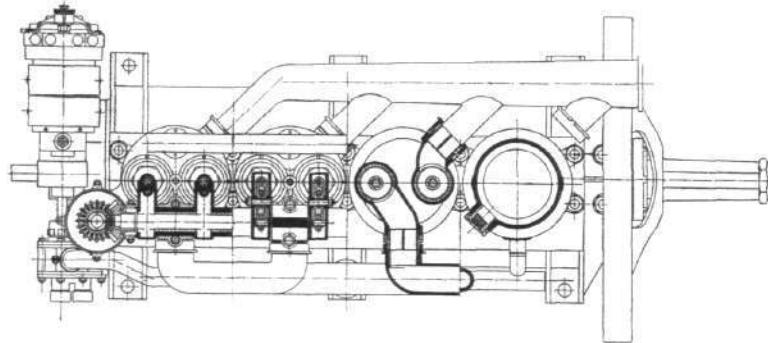


Fig. 3.—Plan view of the Green engine, showing the disposition of the exhaust-pipe.

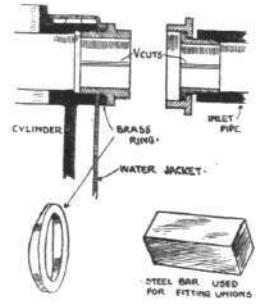
chambers themselves are also extended laterally for the attachment of the induction and exhaust-pipes, the nature of the passages thus provided being very clearly illustrated by an accompanying sectional drawing (Fig. 3) showing a plan view of the cylinder. The lower end of the cylinder casting is flanged, the flange being extended at intervals to form five lugs, through which the holding-down bolts pass. These five lugs are not equally spaced round the flange, owing to the offset position of the cylinder on the base-chamber, but four of the holding-down bolts pass right through to the crank-shaft bearing, and the fifth is a stud projecting from the roof of the crank-chamber. Immediately below the flange the cylinder casting projects a little way in order to form a spigot, and a short distance above the flange there is another flange of smaller dimensions that has a grooved periphery. In this groove, a rubber ring is placed, which maintains a water-tight joint for the lower end of the copper jacket.

The copper jacket is pressed from the solid sheet and is slightly bell-mouthed at its lower end, so that it can be more readily pushed into place over the rubber ring, which projects a little from the grooved flange. There are only two fittings on the copper jacket of the Green engine, and each is a spigot coupling for the attachment of the water pipe by means of a rubber tube connecting-piece. The jacket itself is fastened in place in a manner that is worthy of description in detail. It will be noticed on reference to one of the accompanying illustrations (Fig. 2) that the copper is perforated in certain places; these holes coincide with the orifices that communicate with the interior of the cylinder casting. When the cylinder-jacket is placed over the cylinder it is pressed down until its upper end rests upon flanges projecting near the extremities of the valve-chamber. These

flanges are machined smooth and true, and the copper jacket is pressed hard up against them by means of a pair of ring nuts that engage with the screw thread cut upon the exterior of the valve-chambers. Its fastening holds the upper end of the jacket rigidly in place and is also watertight; the lower end of the cylinder jacket is quite free to slide over the rubber ring, but this joint is also watertight.

Pipe Work.

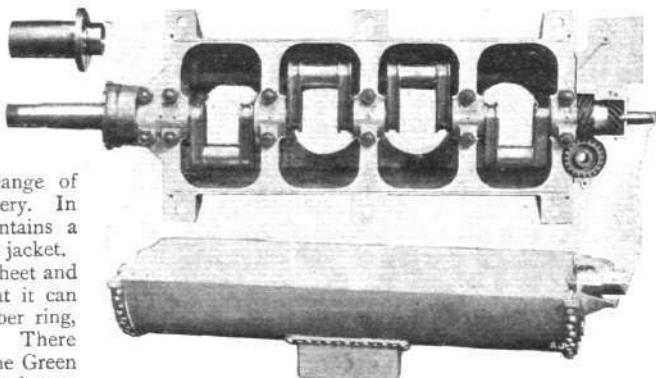
There remain three orifices in the walls of the water-jacket that have to be sealed. Two coincide with the in-



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Fig. 4.—Sketch showing the coupling used for connecting the induction and exhaust-pipes to the cylinders on the Green engine.

duction and exhaust ports of the valve-chambers, the other adjoins the boss into which the ignition-plug is fastened. Each position is alike in that it occurs on the curved wall of the jacket and cannot therefore be sealed by an ordinary flat-faced nut. The extensions of the cylinder casting now under consideration are all carefully machined in the lathe so that their extremities are rounded off to exactly the same curvature as the copper jacket that



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Fig. 5.—View showing the crank-shaft in place in the crank-chamber; underneath, the aluminium base-chamber is shown separately.

abuts against them. By this means a water-tight joint is secured when its two surfaces are pressed together by the aid of a nut bearing upon a suitably shaped washer. The washer that comes between the nut and the copper jacket is a ring of brass, curved on one face to fit the walls of the cylinder jacket, and flat on the other face to

form an abutment for the nut. The nut itself is in reality a kind of ferrule consisting of a steel tube having a flange in the centre and being cut with a screw thread on the exterior at each end.

One extremity of the ferrule is inserted in the cylinder casting, which is screwed to receive it, and the ferrule is then tightened up until the flange presses upon the brass washer. A very ingenious device has been thought out to facilitate the tightening up of these ferrules, the method employed being to cut four notches inside the ferrule, and

to insert a square steel plug which, projecting at one end, affords a good grip for a big spanner. The details of the joint are illustrated by an accompanying sectional sketch (Fig. 4), in which the steel bar used for the purpose of fitting the unions is shown separately. This same sketch also illustrates how the pipes are attached to the extremity of the ferrule by means of a special form of union. The extremity of the pipe is screwed to receive a flanged ferrule, and the ferrule carries a loose ring nut by means of which a connection is made to the ferrule in the cylinder casting. This system dispenses with flanges and bolts, and incidentally makes a particularly neat-looking job of the joint.

Mention has already been made of the manner in which the induction and exhaust-pipes are attached to the cylinders, but brief reference is also necessary to the construction of the exhaust-pipe itself, as it embodies a point of interest. The exhaust-pipe (Fig. 3) is a welded steel tube of tapering section, and has short branches by which it is coupled up to the different cylinders. The important point in this design is that these branches instead of being at right angles to the pipe, lie obliquely, and all slope the same way. We understand from the manufacturers that this has been found to overcome all difficulties in connection with expansion and contraction. Their experience has been that any other form of steel pipe would very easily crack; moreover, the oblique entry of the branches into the main channel is commendable on scientific grounds. The induction-pipe, which is made of aluminium, is so designed that the length of piping to each cylinder is equal, and, therefore, the suction effect on the carburettor should be uniform.

Crank-Chamber and Crank-Shaft.

The crank-chamber, to which the cylinders are bolted down in the manner already described, consists of an aluminium casting webbed on the inside to provide five bearings to the crank-shaft and ribbed on the outside to give six supporting brackets, three on either side. The lower part of the crank-chamber consists, for the most part, of a sheet of aluminium, which makes a tongue and



FLYING WITH TWO PASSENGERS—NEW RECORDS.

FLYING with his new type of machine, Henry Farman easily beat his own record for a double passenger flight by taking two companions during a trip of 16½ mins. on the 4th, but this was completely put in the shade on Saturday last, when he flew for 1h. 2m. 23s., accompanied by Mr. Hewartson and Madame Frank. During this trial a speed of about 50 miles an hour was attained, about twice that which was accomplished by

groove joint with the lower face of the crank-chamber casting (Fig. 5). This lower part of the crank-chamber is merely an oil sump and is not subjected to any strain. The sheet aluminium central portion is attached by rivets to a pair of cast aluminium end-plates, by means of which it is fastened by bolts to the upper part of the crank-chamber. Additional security is obtained by the use of aluminium straps passing completely under the lower base and being secured to the side walls of the crank-chamber. These straps are hinged at one end, and are provided with a quick-acting adjustable fastening at the other. In the centre of the base-chamber is a small aluminium casting forming a sump for the collection of the oil that feeds the oil pump, as will be described presently.

The crank-shaft, which is of large external dimensions, is hollow for the sake of lightness, and for the same reason the crank-webs are grooved in an unusual manner round their peripheries. The crank-shaft is, as we have already mentioned, supported on five bearings, all of which have white metal surfaces on detachable brass liners. The caps that hold the bearings in place are secured by the same bolts that hold the cylinders to the crank-chamber.

One end of the crank-shaft receives the propeller, the attachment of which will be described presently, and the other end carries a pair of skew-cut gear-wheels or worms for driving the magneto and cam-shaft spindles. The threads of these two gear-wheels slope in opposite directions, and the slope of the teeth on the outer wheel is such that the wheel tends to move further on to the shaft; its position is fixed by an aluminium distance-piece separating it from the other gear-wheel (Fig. 6). Under this aluminium distance-piece, which forms a loose sleeve on the shaft, is a split ring engaging in a groove on the shaft. The split ring stands up a little way above the surface of the shaft and thus affords an abutment for the end thrust of the other gear-wheel. These gear-wheels, and the other gear-wheels that they drive, are enclosed by an aluminium casting, which also forms an end-plate for the crank-chamber and provides a bracket for the support of the magneto and water pump.

(To be continued.)



Mr. Henry Farman at Rheims when carrying two passengers.

The new Henry Farman machine, although embodying the main features of the Farman type, has been considerably revised. The upper main-plane has been lengthened, while the lower one has been shortened. The biplane tail has now been abandoned in favour of single horizontal and vertical planes bisecting each other.

THE SECOND OLYMPIA AERO SHOW.

THE second British Aero Show, which opened at Olympia on Friday of this week and will continue as the leading "sight" of London until Saturday, March 19th, bears every evidence of marking an epoch in the history of flight, the full importance of which time alone will afford the means of correctly judging. Last year the first British Aero Show was in every way a remarkable exhibition, and although the present occasion may not afford quite that same interest to the merely curious, the industrial side of the display more than makes up for any relative absence of absolute novelty about the Exhibition as a whole.

We cannot imagine anyone visiting the present Aero Show without being deeply impressed with the extraordinary development that has already taken place in this embryonic industry. Merely to glance through the list of exhibitors is to feel a deep sense of the enormous possibilities that lie ahead along the path of flight. To find in the list of aeroplanes alone over a score of different names is to realise—perhaps for the first time on the part of those who have been inclined to look upon the whole subject of aviation as being altogether "in the air"—that the manufacture of flying machines is already an established business in Britain. And, when we say "manufacture," most decidedly do we mean *building* and not *importation*, for it is one of the most gratifying features of the present Show that so many of the machines are British built.

Firms like Short Bros., Handley Page and Howard Wright, who exhibited flying machines at the first Aero Show, are now surrounded by quite a crowd of new comers, among whom are some well-known firms from the automobile industry like the Humber and Star Companies. Particularly do we welcome the advent of Mulliner of Long Acre, and Holland and Holland, as representing British coachbuilders, who have very properly interested themselves in a department of manufacture wherein they ought to excel, since, for the time being at any rate, aeroplanes are mostly made of timber. Among other British machines are the Avroplane, Avis, Blackburn, Lane, George and Jobling and Ornis; so that the Blériot, Henry Farman, Santos Dumont, Sommer and Zodiac, which have been constructed abroad, are this time

numerically in the minority compared with home products. Considering that the industry started in France, and bearing in mind the reputation for going slow, which is so often attributed to this country, such evidence of activity at this early stage of the proceeding is commendable to say the least.

Inseparably a part of the aeroplane industry is the manufacture of suitable engines, and whether this is or is not ultimately carried on by the same firms that build the remainder of the flying machine is of relatively little significance compared with the enormous importance of the fact that it must ever be a section of the work under any circumstances. And here again a glance at the lists of exhibits not only impresses one with the magnitude that it has already assumed but also gives rise to a feeling of satisfaction that British firms are so well to the fore. Altogether, there are well over forty engines on view, ranging from 5-h.p. to over 100-h.p.

If, on the top of these exhibits, is added the Willows dirigible and the long list of articles and accessories associated with the manufacture of aeroplanes and engines, which in themselves engage the exclusive attention of quite a number of firms, it will be seen that already the industry represented by flight—that erstwhile wild dream of man's far-seeing mind—is no mean thing. Indeed, the sudden and almost unexpected seriousness of it all seems to be the key-note of the present situation.

For the convenience of our readers we have endeavoured to compile a forecast of the exhibits in a form that will be really useful to them as they make a tour of inspection. To that end, we have, as far as possible, classified the exhibits themselves and arranged the exhibitors alphabetically in their respective classes. If, therefore, one reader wishes to spend the day in the selection of an engine while another is "looking out" for a flyer, our list should materially facilitate a task that from our own experience of exhibitions is apt to become a little tedious, notwithstanding the initial zest with which it is ordinarily begun. Some notes that have been supplied in advance by the firms themselves are appended herewith, but the gist of the information has been arranged in tabular form for ready reference.

AEROPLANES.

The figures in brackets are the Stand Numbers.

Avis (57).

BRITISH-BUILT monoplane, exhibited by the Aeroplane Supply Company for the Scottish Aeroplane Syndicate. Particulars of this machine are given in detail on page 181.

Blériot (57, 79, 81).

REPLICAS of the monoplane on which Mons. Blériot flew across the Channel, exhibited by Messrs. Blériot, Limited, Messrs. Humber, Limited, and the Aeroplane Supply Company. A full description of this machine, together with scale drawings, appeared in FLIGHT for July 31st last, just after the historic trip. The main planes measure about 25 ft. 6 ins. across, and the overall length is about 26 ft. The engine is a three-cylinder Anzani, weighing 65 kilogs., of which the bore and stroke are 105 mm. x 130 mm.

Blackburn (-).

MONOPLANE with a spread of 24 ft. and an overall length of 23 ft. A special feature of the machine is the patented device to give automatic stability.

Henry Farman (77).

A amateur French-built biplane embodying many of the latest improvements introduced by Mr. Henry Farman, and fitted with a Darracq motor. Shown by Capt. A. Rawlinson.

G. and J. (76).

BRITISH-BUILT biplane of 30 ft. span, the supporting surface of the main planes being 325 sq. ft., while the total surface, including tail, elevator and ailerons, is 438 sq. ft. A feature of this machine is the triplicate control, whereby both rudder, elevator and ailerons can be operated by one hand without any one motion interfering with any other. The rear tips of the top plane are extended and flexible, and coupled to the ailerons, so that lateral stability is governed both by the entering edge of the aileron and the trailing edge of the flexible tips.

Gregoire-Gyp (75).

FRENCH-BUILT monoplane of a type intermediate between the Antoinette and Blériot. The main wings are of 34-ft. span, and are warped for steering and securing lateral stability. Control is by two hand-wheels, one on each side of the driver, that on the right warping the wings, while the one on the left operates the horizontal rudder, the vertical rudder being worked by a foot-bar. The machine is carried on a combined skate-and-wheel frame, the wheels being used to run on the ground for starting purposes, and the skids coming into operation on landing.

Handley-Page (82).

MONOPLANE of 30 ft. span, the wings having a cord of 6 ft. It is controlled by a rudder at the rear, actuated by a lever at the side of the pilot. Total lifting surface of the machine 150 sq. ft., and weight without the pilot 300 lbs. It is fitted with a 20-25-h.p. air-cooled 4-cyl. engine, directly coupled to a 6 ft. 6 diam. special H.P. propeller.

Humber (53).

Two British-built monoplanes of the Blériot type are on view on Messrs. Humber's stand, as well as a monoplane and a biplane designed by Capt. Lovelace. The main planes of the last-mentioned are of 41' 6" span, and the total lifting surface is 526 sq. ft. The Lovelace type monoplane is of 29 ft. span with a total lifting surface of 232 sq. ft. In each the engine fitted is a 50-h.p. 4-cyl. water-cooled Humber.

Lane (78).

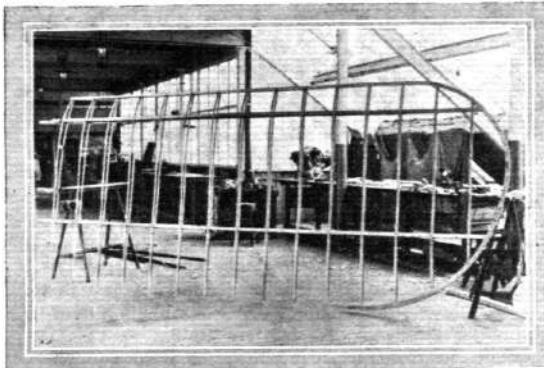
Two monoplanes, one of 30-ft. spread, and the other of 36-ft. span, the former fitted with a 30-h.p. engine, and the latter a 60-h.p. engine, both of the N.E.C. type.

Mann and Overtons (70).

A MONOPLANE, very much on the lines of Santos Dumont's "Demoiselle," fitted with a twin-cylinder V-type air-cooled Anzani engine of 20-h.p.

Mulliner (69).

NEW British monoplane, built by the well-known coachbuilders of Long Acre and Northampton. The main planes have a span of 33 ft. and a chord of 6 ft. 6 ins., while the overall length of the machine, which has a total lifting surface of 220 sq. ft., is 27 ft. It



One of the main planes of the Mulliner monoplane in skeleton form.

is fitted with a 35-40-h.p. 8-cyl. J.A.P. engine, which drives a 6 ft. 3 ins. tractor screw of 4 ft. 6 ins. pitch. Stability and directional control are effected by a system of warping the trailing edge of the main planes, combined with the action of the elevator and rudder at the rear.

Nicholson (58).

MONOPLANE built by Holland and Holland and exhibited on the stand of the Royal Aero Club.

Ornis (71).

A MONOPLANE of 25 ft. span and 28 ft. overall length, with a surface of 170 sq. ft., the weight complete being 450 lbs. It is fitted with a four-cylinder air-cooled Lascelles engine, driving a Weiss propeller.

ENGINES.**Aeroplane Engine Co. (33).**

EIGHT-CYLINDER V-type engine for dirigible, the bore and stroke being 4 ins. by 4½ ins., and the weight of the engine complete 498 lbs. Also a four-cylinder engine, with cylinders of similar size, and of the same general design. Both engines have auxiliary exhausts, and the carburettor is specially designed to work at any angle.

Albatross (48).

A SIX-CYLINDER "V"-type engine, of which the bore and stroke are 110 x 110. The engine weighs only 230 lbs. complete, and is rated at 35-45-h.p.

Petre (68).

MONOPLANE exhibited by Messrs. Leo Ripault and Co., and fitted with an N.E.C. engine.

Roe (66).

BRITISH-BUILT triplane, having a span of 20 ft. ; the height of the machine is 9 ft. and the overall length 23 ft. The total supporting surface, including that of the triplane tail, is 320 sq. ft. The machine is driven by a two-bladed tractor screw of adjustable pitch, and the steering is effected by a vertical rudder at the rear operated by the feet. The main planes are operated by hand to serve as elevators.

Santos-Dumont (72).

REPLICAS of the little "Demoiselle" monoplane built in France by Mons. A. Clement. A fully-illustrated description, with scale drawings, appeared in our issues of October 2nd and 9th last. It is fitted with a two-cylinder water-cooled motor, and the weight complete is about 110 kilogs. The overall measurements are 6' 2 metres long and 5' 5 metres wide.

Short (59, 67).

A BRITISH-BUILT biplane of special light design, and fitted with a 30-35-h.p. 4-cyl. Green engine. A feature of the design is the patent front elevating rudder, while another special detail is the arrangement of spring tension balancing planes. The lifting surface of the machine is 270 sq. ft., while the weight complete is 700 lbs. A similar machine is also exhibited by Mr. J. T. C. Moore-Brabazon on the Royal Aero Club's stand.

Short-Wright Machine (58, 59).

BRITISH-BUILT biplanes, after the design which has been evolved by the Wright Brothers. The machine on view is that with which the Hon. C. S. Rolls has been flying at Eastchurch.

Sommer (58).

BIPLANE, designed and built by M. Sommer as a result of his successful experience with a biplane of the Henry Farman type. It is exhibited by the Hon. C. S. Rolls.

Spencer-Stirling (54).

MONOPLANE having a span of 34 sq. ft. and a lifting surface of 200 sq. ft. It is fitted with an R.H. 4-cyl. engine.

Star (80).

BRITISH-BUILT monoplane of the "Antoinette" type, the span being 42 ft., while the wings have a cord bearing from 8 ft. 6 ins. at the junction with the body to 6 ft. at the tips. It is driven by a 6-ft. tractor screw connected to a 40-h.p. engine. The tail is formed of 4 planes which steer and elevate in the usual way, but also can be warped for maintaining lateral stability, and the whole of these movements are carried out from the one steering-wheel.

Twining (64).

BIPLANE of the tail-less type, with a monoplane elevator in front. The main planes have a span of 28 ft., whilst the cord is 4 ft. 6 in. The gap at the centre is 5 ft. 6 in., diminishing to 4 ft. 6 in. at the tips, the lower plane being curved upwards at the ends. Lateral stability is maintained by means of ailerons pivoted on the end stanchions, at an angle of 45° to the horizontal. The ailerons are inter-connected, having a constant angle of 90° between them, so that the movement of one in a certain direction is followed by a corresponding movement of the other in the opposite direction.

Warwick Wright (74).

BRITISH-BUILT monoplane having a spread of 27 ft. and an overall length of 29 ft., the lifting surface being 160 sq. ft. It is fitted with a 40-h.p. E.N.V. engine weighing 155 lbs. The machine is mounted on runners which in turn are fitted with wheels and rubber springs. By these means the machine is able to rise from the ground without the aid of a starting apparatus, and at the same time the advantage of skids for alighting is obtained.

Zodiac (56).

A BIPLANE and a monoplane, exhibited by the British and Colonial Aeroplane Co., being the type which it is proposed to build at that firm's works at Bristol, of which Sir Geo. White is at the head.

Avro (66).
Two-STROKE motor with two cylinders set at an angle of 180°. The charges are drawn into the crank-case by both pistons, at the same time through an ordinary inlet-valve of large size. On the piston's return the charge is compressed until the ends of six channels cut outside the cylinder-walls are uncovered, thus permitting the charge to pass along the piston, at the same time the exhaust is passing out through six holes in the cylinder-walls. Both cylinders are fired at the same moment, giving perfect balance.

Buchet (47).

Two types of these engines are shown by Messrs. Brown Bros.,

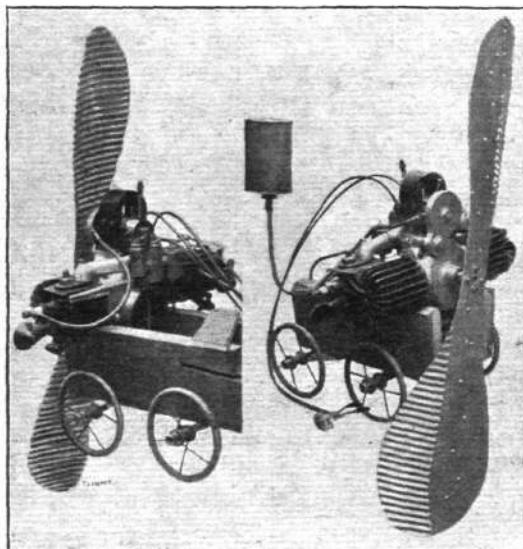
one a 4-cyl. model and the other a 6-cyl. motor of 45-h.p. The bore and stroke of the cylinders of the latter are 90 by 110 mm., and the weight, including fly-wheel, carburettor, &c., is 286 lbs.

Clement (72).

Of the three motors exhibited by Mons. Clement, one of 40-h.p. has 4 cylinders 110 mm. \times 120 mm.; another, 4 cylinders 155 mm. \times 185 mm.; while the third is of similar dimensions, but has 6 cylinders. The two latter have the cylinders cast in pairs, whilst the former has the 4 cylinders cast *en bloc*. On the two largest the cylinders have a special arrangement of compression-release taps for starting purposes.

Cochrane (—).

— SPECIAL small motors of light design, ranging from $\frac{1}{2}$ -h.p. to 3-h.p., as well as two motors of 20-h.p. and 30-h.p. respectively.



The above illustrations show a twin-cylinder horizontal engine and propeller that have been supplied by Messrs. Cochrane to Mr. H. Moya, and is on view at Olympia for the purpose of demonstrating a system of vertical and horizontal steering by means of the propeller. The engine is fitted with a Bosch high-tension magneto, and develops 3-h.p. The propeller is 3 ft. 3 ins. in diameter, and gives a pull of 17 lbs. at 1,200 r.p.m.

Darracq (77).

TWO motors are of the horizontal opposed type and two with vertical cylinders. One of the former, of 25-30-h.p., with two cylinders, was used by M. Santos-Dumont in his cross-country flights on his "Demoiselle" machine. The other horizontal engine has four cylinders, and is of 50-60-h.p. Of the other two engines, both of which have four cylinders, one is of 50-60-h.p. and the other of 100-120-h.p.

E.N.V. (74).

TWO engines of this make are shown by Messrs. Warwick Wright, Ltd., one of four cylinders giving 20-30-h.p., the weight being under 2½ lbs. per horse-power, while the other engine has eight cylinders, is of 50-80-h.p., and weighs 287 lbs., the bore and stroke being 105 by 110 mm.

Green (40).

TWO engines, both with four cylinders, one of 30-35-h.p., of which the bore and stroke are 105 by 120 mm., and the other of 50-60-h.p., the bore and stroke being 140 by 146 mm. The weight of the former engine without the fly-wheel is 150 lbs., while the latter weighs 250 lbs. Full particulars regarding the construction of these engines will be found elsewhere in this issue.

Gregoire-Gyp. (75).

A 30-40-h.p. motor, having four vertical cylinders cast *en bloc*, the bore and stroke being 92 by 140 and the guaranteed horse-power 35 at 1,600 revolutions. The engine complete with high-tension magneto, carburettor, and lubricator weighs 156 lbs.

Humber (53).

THREE-CYLINDER air-cooled motor of 30-h.p., the bore and stroke of the cylinders being 108 \times 135 mm. Also 50-h.p. four-cylinder water-cooled engine with copper jackets, the cylinders having a bore and stroke of 110 \times 120 mm. being cast separately.

Lamplough (37).

TWO different types of engine. One known as the positive explosion turbine has four equidistant tubes open at both ends which form charging and firing cylinders, double pistons in each cylinder being connected by rods to the periphery of the oscillating ring at each end of the motor. These rings carry rollers that bear upon angular paths and by this means the shaft is revolved. In the other engine the four cylinders are fed from a special charging cylinder.

Lascelles (71).

FOUR-CYLINDER semi-radial air-cooled engines of 35-h.p., bore and stroke being 100 \times 120 mm., and the weight 150 lbs. complete.

N.E.C. (88).

THREE types of engines for aerial work, having two, four and six cylinders, and being of 15-20, 35-40, and 50-60-h.p. respectively. They are of the two-cycle type, and the design is the outcome of many years' work devoted to the perfecting of this type of engine by the N.E. Co. An interesting part of the engine is the central mechanism which is employed for forcing in the air and gas and for timing the inlet of the gas so that none of it escapes through the exhaust port.

Phoenix (30).

RADIAL rotary motors of ten different powers, having from 2 to 12 cylinders, and ranging from 4-h.p. to 100-h.p. The bore and stroke of the smallest is 2½ ins. \times 2½ ins., while of the largest it is 4½ ins. \times 5 ins.

Renault (49).

TWO engines intended for aeroplane work are on exhibition on the Stand of Messrs. Renault Frères. One is of 50-h.p. and has eight cylinders of which the bore and stroke are 90 by 120 mm. The cylinders are air-cooled and arranged in the form of a V. The other engine is of 25-h.p. and has four cylinders.

R.H. (54).

EXHIBIT by Berliet Motors. Four-cylinder vertical engine, designed and constructed by the R.H. British Aeroplane Syndicate. The cylinders are separate and have a bore and stroke of 5 ins. The weight is 340 lbs., including a fly-wheel that weighs in itself 65 lbs. The fly-wheel has been built with a steel-rim support on wire brakes, like a bicycle wheel built by Rudge-Whitworth.

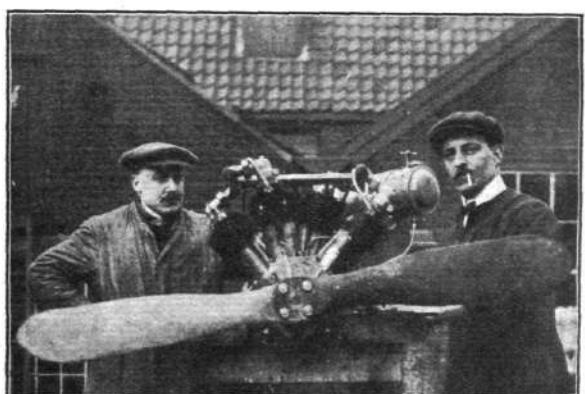
S.E.M. (11).

A TWO-CYLINDER tandem air-cooled valveless engine of which the bore and stroke are 110 by 120 mm., the weight 110 lbs., while the engine gives 25-h.p.

Star (80).

THE engine has four steel cylinders having a bore and stroke of 4 in. by 5 in. The water jackets are deposited copper, while the valves are overhead and mechanically operated. All the bearings are made unusually large, and the crank-shaft, gudgeon-pins and

(Continued on page 193)



Photograph of the Warren-Simpson 4-cyl. engine, from which can be seen the peculiar arrangement of the cylinders.

ACCESSORIES & BALLOONS.

Stand No. Absorbers.

82 Handley Page, Ltd.

Airships.

Willows.

Balloons.

65 Continental, 80,000 cub. ft.
(Built by Short Bros. for M. Singer.)

28 C. G. S. Spencer & Sons.

Carburetors.

44 Trier & Martin.

Clothing.

Samuel Bros.

Dynamometers.

50 Acer, Ltd.

Emery Cloth and Powder.

46 W. P. Nixey.

Engines for Models.

57 Aeroplane Supply Co.

25 Cochrane & Co., $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{2}$, 3-h.p.

Davies, J.—
H.p. Cyls. Bore. Stroke. Wt.
 $\frac{1}{2}$ 2 $1\frac{1}{2}$ $1\frac{1}{2}$ $4\frac{1}{2}$
 $\frac{3}{4}$ 4 $1\frac{1}{2}$ $1\frac{1}{2}$

Fabrics.

65 Continental—
Gliders, 3' 0 oz. per sq. yd.

Flyers, 3' 6 "

" 4' 7 "

Balloons, 6' 5 "

Airships, 8' 2 "

45 Dunlop—
A1, single faced, 2' 7 "
A2, " 3' 2 "
A3, " 3' 8 "
A4, " 4' 2 "
A5, double faced, 2' 4 "
A6, " 3' 4 "
A7, " 4' 2 "
A8, " 4' 4 "

7 Hart, A. W.
No rubber used in proofing.

26 Hutchinson—
1, Single faced 3' 0 oz. per sq. yd.
2, Double " 5' 1 " "
3, Single " 4' 4 " "
4, " 2' 8 " "
5, Double " 4' 4 " "
6, " 4' 4 " "

20 M'Lean, M'Lean and Co.
35 North British Rubber Co.
Pegamoid, *see* Star, Lane and Roe.

28 Spencer and Sons.

Frame Fittings.

30 Phoenix Radial Rotary Mot. Co., Ltd.

36 Motor Accessories Co.

82 Handley Page.

51 Harris & Samuels.

Fuel.

Express (Bowley & Sons).
Bomo (Bowley & Sons).

Horns.

36 Klaxon (Motor Accessories Co.).

Gyroscopes.

27 A. Rutt.

Indicators.

41 S. Smith & Son.

Lamps.

79 Blériot.

Lubricants.

46 W. P. Nixey.

S. Bowley & Son.

Metals.

Hoyt Metal Co.

43 Rubery, Owen & Co.

Models.

Aeroplanes (to scale)—

9 Antoinette (C. B. Timperley).
64 " (Twining Aeroplane Co.).

AEROPLANES.

Stand No.	Type.	Span.	Area.	Length.	Weight.	Price.
	ft.	ft.	sq.	ft.	lbs.	£
57	Avis (Aeroplane Supply Co.)	28	160 27	430	370	Price exclusive of engine.
66	Avroplane (A. V. Roe & Co.)	20	20	—	—	35-h.p. Green engine.
	Blackburn (Blackburn Aeroplanes)	24	23	—	—	30-35-h.p. Green engine.
57	Blériot (Aeroplane Supply Co.)	25	26	—	—	Type XI Cross-Channel.
79	Ditto (Blériot, Ltd.)	25	26	—	—	Ditto.
81	Ditto (L. Blériot)	25	26	—	—	Ditto.
24	Chanute Glider (T. W. K. Clarke)	22	10	—	—	
60	Electric Vehicle Co.	—	—	—	—	
76	George & Jobling	30	325	660	—	50-h.p. Green engine.
75	Gregoire-Gyp (Fiat Motors, Ltd.)	—	307	—	—	
82	Handley Page (Handley Page, Ltd.)	30	150	300	—	Wright, exclusive of engine.
77	Henry Farman (Capt. A. Rawlinson)	33	39	—	—	40-h.p. Darracq.
53	Humber (Humber, Ltd.)	33	192 27	450	30-h.p. 3-cyl. Humber engine.	
53	Ditto	—	—	775	50-h.p. 4-cyl. ditto.	
53	Ditto	41	482 36	1100	50-h.p. 4-cyl. ditto.	
78	Lane (Lane's British Aeroplanes, Ltd.)	30	24	—	—	30-h.p. N.E.C. engine.
78	Ditto	36	24	—	—	60-h.p. N.E.C. two-seater.
69	Mulliner (Mulliner, Ltd., Northampton)	33	220 27	—	—	35-40-h.p. 8-cyl. J. A. P.
58	Nicholson (Holland & Holland)	—	—	—	—	
71	Ornis (R. Lascelles & Co., Ltd.)	25	170 28	—	—	4-cyl. Lascelles engine.
68	Petre (Le Ripault)	—	—	—	—	N.E.C. engine.
72	Santos-Dumont (A. Clement)	18	108 20	242	—	La Demoiselle type.
70	Ditto (Mann & Overton, Ltd.)	20	20	—	—	20-h.p. Anzani.
59	Short (Short Bros.)	30	30	650	—	
67	Ditto (Moore-Brabazon)	—	—	—	—	
59	Short-Wright (Short Bros.)	—	—	—	—	
58	Ditto (Hon. C. S. Rolls)	—	—	—	—	
58	Sommer (Hon. C. S. Rolls)	—	—	—	—	
54	Spencer Stirling (Berliet Motors)	34	200 27	650	—	R.H. engine.
80	Star (Star Engineering Co.)	40	290 32	—	—	40-h.p. Star engine.
64	Twining (Twining Aeroplane Co.)	28	—	—	—	20-h.p. Phoenix engine.
74	Warwick Wright (Warwick Wright, Ltd.)	27	160 29	300	650	Weight, exclusive of engine.
56	Windham	—	—	—	—	
56	Zodiac (British & Colonial Aeroplane Co.)	33	525 39	1100	1000	50-60-h.p. engine.
56	Ditto	30	193 26	660	500	30-h.p. engine.

Note.—Type B = biplane; M = monoplane; T = triplane.

Accessories—continued.

24 Blériot XI (T. W. K. Clarke).

(C. B. Timperley).

9 " (1 in. to 1 ft.) (Blériot, Ltd.).

22 Gratz (Gratz, Ltd.).

36 Neale VI (Motor Accessories Co.).

24 Wright (T. W. K. Clarke).

9 " (C. B. Timperley).

Dirigible—

35 North British Rubber Co. (15 ft. x

3 ft. 8 ins. x 6 ft.).

Magnets.

38 Bosch (H.L. 6) six-cylinder engines

(Bosch Magneto Co.).

38 Bosch (H.L. 8) eight-cylinder engines

(Bosch Magneto Co.).

48 Simms (Simms Magneto Co.).

Parachutes.

28 C. G. S. Spencer & Sons.

Propellers.

16 Asco (Aeroplane Supply Co.).

24 Clarke (T. W. K. Clarke & Co.).

25 Cochrane Aluminium (Cochrane & Co.).

77 Chauvière (Capt. Rawlinson).

Eyquem's Patents, Ltd.

82 Handley Page, Ltd.

78 Lane (Lane's Brit. Aeroplanes, Ltd.).

31 Macfie (R. F. Macfie & Co.).

36 Motor Accessories Co.

88 N.E.C. (New Engine Co.).

31A Pitter (W. C. Pitter).

30 Phoenix (Phoenix R. R. Mot. Co., Ltd.).

71 Weiss (R. Lascelles & Co.).

Radiators.

19 Spiral Tube & Components Co.—
(16 to 20 ozs. per h.p., including
water).

42 Zimmerman (Mot. Radiator Mfg. Co.)—
(Used by German Govt., Wolseley
Co., Mr. S. F. Cody, War
Office, and M. de Baeder).

Rubber.

13 New Motor & General Rubber Co.,
Ltd., "Rubmetal."

45 Dunlop Rubber Co.

Sheds.

10 Aerial Mfg. Co.

Tools.

52 Melhuish & Co.

Toy Flyers.

24 Clarke (T. W. K. Clarke).

23 New Things, Ltd.

9 Timperley (C. B. Timperley).

Timber.

24 T. W. K. Clarke.

21 W. Mallinson & Sons.

Tyres.

35 Clincher (North Brit. Rubber Co., Ltd.).

13 New Motor & General Rubber Co., Ltd.

Tuition.

16 Motor Schools, Ltd.

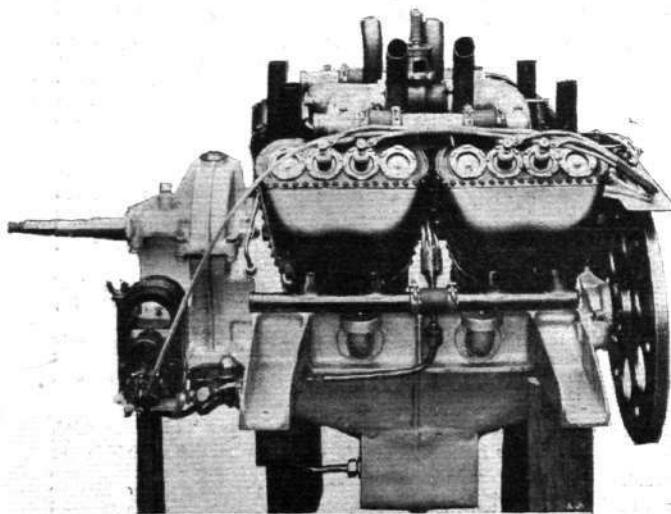
Tanks.

17 John Thompson.

30 Phoenix Radial Rotary Motor Co., Ltd.

ENGINES.

Stand No.		Cyls.	Bore	Stroke.	Weight	
	h.p.		in. or mm.	lbs.		
33	— Aeroplane Engine Co. ...	8	4 43	488	V type.	
33	— Ditto ...	4	4 43			
48	30-35 Aeromotor (Aero Motors, Ltd.) ...	6	110 110	230	V type.	
57	25 30 Anzani (Aeroplane Supply Co.) ...	3	100 150	130	Air-cooled, semi-radial.	
70	20 Anzani (Mann & Overtoms) ...	—	—	—	Also see Blériot monoplanes.	
57	30-35 Alvaston (Aeroplane Supply Co.) ...	2	—	—	Horizontal opposed.	
66	— Avro (A. V. Roe & Co.) ...	—	—	—	Two-stroke.	
47	15 Buchet (Brown Bros.) ...	6	—	—		
47	25 Ditto ...	4	—	—		
72	180 Clement (A. Clement) ...	6	155 185		For dirigibles.	
72	130 Ditto ...	4	—	—	Ditto.	
72	40 Ditto ...	4	110 120	242		
77	40 Darracq (Capt. A. Rawlinson) ...	—	—	—	On Henry Farman biplane.	
74	25-30 E. N. V. (Warwick Wright, Ltd.) ...	4	85 90			
74	40 Ditto ...	8	85 90	155		
74	60-80 Ditto ...	8	105 110	287		
75	100 Fiat (Fiat Motors, Ltd.) ...	—	—	—		
40	30-35 Green (Green Motor Patent Synd., Ltd.) ...	4	105 120	—		
40	50-60 Ditto ...	4	140 146	—		
75	30-40 Gyp (Fiat Motor, Ltd.) ...	4	92 140	—	Made in England.	
75	100-120 Ditto ...	—	—	—		
82	50 Handley Page ...	4	—	—	Horizontal opposed.	
68	Herdle-Bruneau (Leo Ripault) ...	—	—	—		
53	30 Humber (Humber, Ltd.) ...	3	108 135	155		
53	50 Ditto ...	4	110 120	190		
57	35 J. A. P. (Aeroplane Supply Co.) ...	8	85 110	200	Also see Mulliner monoplane.	
71	35 Lascelles (R. Lascelles & Co., Ltd.) ...	4	100 120	140		
37	— Lampough & Sons) ...	—	—	—	2-cycle engine, special design.	
88	15-20 N.E.C. (New Engine Co., Ltd.) ...	2 3 1/2	4 1/2	100	Ditto.	
88	35-40 Ditto ...	4	—	155	Ditto.	
88	50-60 Ditto ...	6	—	210	Ditto.	
30	5 Phoenix (Phoenix R. R. Motor Co., Ltd.) ...	2 2 1/2	2 1/2	16 1/2	Radial rotary engine.	
30	12 Ditto ...	2	4	42	Ditto.	
30	24 Ditto ...	4	4	95	Ditto.	
30	30 Ditto ...	5	4	125	Ditto.	
30	100 Ditto ...	12	4 1/2	350	Ditto.	
37	60-75 P. E. T. (Lampough & Sons) ...	—	—	—	Rotary engine.	
49	50 Renault (Renault Frères) ...	8	90 120	—	Air-cooled.	
49	25 Ditto ...	4	90 120	—	Ditto.	
54	R. H. (Berliet Motors) ...	4	5	340	Weight includes fly-wheel of 65 lb.	
11	25 S. E. M. (Smith & Dorey) ...	2	110 120	110		
80	40 Star (Star Engineering Co.) ...	4	4	5 160		
18	25-6 Thames (Thames Ironworks Co.) ...	4	4	4 1/2 120		
32	25 Warren Simpson & Co. ...	4	90 120	—	Air-cooled.	
89	30 Wolseley (Wolseley Co.) ...	—	—	—		
89	50-60 Ditto ...	—	—	—		



Side view of the 50-60-h.p. 8-cyl. Wolseley engine.

Engines—(continued from p. 191).

connecting rods are bored out to reduce the weight, which is 160 lbs., and at 1,400 r.p.m. the engine gives 40.b.h.p.

Thames (18).

FOUR-CYLINDER engine of the horizontal opposed type, the bore and stroke being 4 ins. by 4 1/2 ins. Ball bearings are fitted throughout with the exception of the gudgeon-pin bushes. The cylinders are provided with spun copper water jackets through which the water is circulated by a centrifugal pump driven by the same counter-shaft that drives the magneto. The engine has few moving parts, and the weight considered in relationship to the solidity of construction is very small.

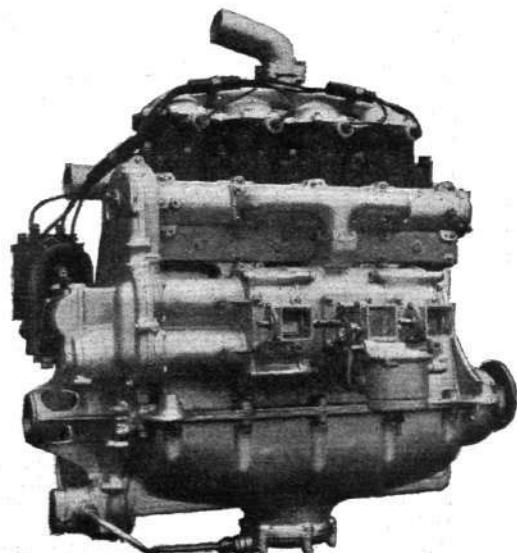
Warren Simpson (32).

FOUR-CYLINDER air-cooled engine, the bore and stroke being 90 x 120 mm., and giving 25-h.p. at 1,200 revolutions. The cylinders, as will be seen from the photograph, are placed V fashion and so that no cylinder blocks the draught of air to any other cylinder. The crank-shaft is mounted on ball bearings and there is also a ball thrust.

Wolseley (89).

THREE types of engines for flight work, one of 30-h.p., four cylinders, vertical, 3 1/2 bore by 5 1/2 stroke, giving 42.b.h.p. at 1,100 revs. Also a 50-60-h.p. engine which has eight cylinders ranged in V, having an angle of 90 degrees, the bore and stroke being 3 1/2 by 5 ins. A 60-h.p. engine is also shown, similar in design to the foregoing except that the stroke is half-an-inch longer. The cylinders are cast in pairs with heads and liners in one piece. The weight complete with fly-wheel is 340 lbs.

The Proprietors of FLIGHT will be pleased to see any subscribers and readers at their Stall at Olympia. This Stall, No. 6, is immediately on the right when entering at the main entrance. In addition to current copies of FLIGHT, and bound copies of Volume I, a very complete picture gallery will be found, containing original photographs and enlargements of most of the celebrated flying machines.



Side view of the N.E.C. engine.

PROGRESS OF FLIGHT ABOUT THE COUNTRY.

(NOTE.—Addresses, temporary or permanent, follow in each case the names of the clubs, where communications of our readers can be addressed direct to the Secretary. We would ask Club Secretaries in future to see that the notes regarding their Clubs reach the Editor of FLIGHT, 44, St. Martin's Lane, London, W.C., by 12 noon on Wednesday at latest.)

Aerial League (CARLTON HOUSE, REGENT STREET, S.W.).

A MEETING in support of the League was held in the Drapers' Hall, London, on Wednesday of last week, when the Lord Mayor presided, and among those present were the Duke of Argyll, Mr. Sheriff Roll, Alderman Sir Charles Wakefield, Sir Hiram Maxim, &c.

In opening the proceedings the Lord Mayor said that the meeting had been called for the purpose of putting before the citizens the great importance of the subject to the Empire at large, and asking them to help the Aerial League of the British Empire financially, in order that it might carry out the great scheme it had in view.

Alderman Sir Charles Wakefield said that they had met to consider a subject which concerned the progress and welfare of the Empire, in that it touched the development of a new and wonderful science, which far-seeing men were now agreed would affect our commerce, our communications, and, to an important extent, the defence of all that British enterprise had won, and which British tenacity intended to hold. The increasing importance of the subject to the British race was only just beginning to be recognised by the community. We were, however, at last realising the danger, not to say the discredit, of allowing ourselves to be outstripped by other progressive peoples in the race for supremacy in the science of aerial navigation. It was high time for the foremost engineering nation to awake to the possibilities which lay before this rapidly-advancing art, and to give encouragement to the men who, in the face of many difficulties, were seeking to uphold the prestige of this country in the air. In view of those facts there seemed to have been just cause for the founding of a national organisation to deal exclusively with the subject in all its varied phases. A point which conduced to confidence in the future of the Aerial League was the fact that agitation was distinctly debarred from its constitution. The absence of any suggestion of political partisanship, and of any desire to obtain support by attaching itself to any particular Parliamentary policy, was recognised as a *sine qua non* of its useful existence.

Recent achievements had inaugurated a new era of human activity, the secret of the ultimate bearing of which the future alone held. A new factor had entered into our schemes of defence, and the value to Great Britain of supremacy on the high seas would appear already to be slightly at a discount now that men were successfully navigating the air. There was no need to take a pessimistic, not to say an alarmist, view; but, when the rapidity with which events had succeeded one another was considered, there was certainly every reason—nay, it was incumbent upon us—to take the bull by the horns, and determine to make up lost ground.

Sir Charles then dwelt upon the great value which would accrue from the Institute of Aeronautics which the League is seeking to found, and urged all his hearers to subscribe to the funds.

A resolution to the effect "That this meeting of the citizens of London heartily approves of the object of the Aerial League in securing a foremost place in the command of the air, as being of vital importance to the commerce and defence of this Empire; and hereby pledges itself to give every support to the programme of active propaganda, and the founding of a national institute of aeronautics," was proposed by the Duke of Argyll, who pointed out that as other countries recognised aviation as of national importance so must we, and if we are to keep abreast of other nations we must have men specially trained for the work. The motion was seconded by Mr. E. P. Frost, Chairman of the Aeronautical Society, and was supported by Sir Hiram Maxim and Major Baden-Powell and carried unanimously.

At Reading Town Hall, on Tuesday, another meeting of the League was held, when the Lord Lieutenant of Berkshire presided. After a lecture on aeronautics by Mr. J. H. Ledeboer, the Solicitor-General (Mr. Rufus Isaacs, K.C.) said the movement they had met to consider was one which would be productive of considerable benefit. He believed the patriotism of the country was equal to all the demands that might be made upon it, and that there would be no difficulty, if the occasion arose, for that patriotic fervour to manifest itself. It was desirable that they should be in the van in a movement of that kind. In the march of science they should not lag behind. He hoped that Berkshire and all the other counties would give their generous support to the League, which could be productive of nothing but good, from whatever standpoint they might look at it.

Arundel House School Ae.C. (15, ARLINGTON ROAD, SURBITON).

THE annual kite contest was held on Saturday, the 5th inst. at Cooper's Hill, Claygate, the wind being ideal for kite flying, and

numerous spectators watched the proceedings with keen interest. There were 17 competitors, and points were awarded for (1) angle of cord, (2) stability, (3) pull of cord, (4) height, and (5) promptness of ascent. K. C. B. Scarf and N. Whitechurch were the winners of the senior and junior contests respectively. The two Ridley weight lifting kites of 120 sq. ft. were also on exhibition and attracted much attention. A full-sized glider is in course of construction, and a suitable flying ground having been obtained experiments will take place during the summer.

Bristol and West of England Ae.C. (STAR LIFE BLDGS., BRISTOL).

SIR GEO. WHITE, president of the club, took the chair at a meeting of the club, held on the 3rd inst. at the Grand Hotel. There were a large number of prominent business men present, testifying to the greatest interest which is now being taken in aviation matters in the West of England. After dwelling upon the objects of the club and reading a congratulatory telegram to the club from the Royal Aero Club, Sir George White went on to say that there were many sides to the question. There was the patriotic side, and they must all feel, as Englishmen, that in this recent advancement in scientific matters, in automobile construction, &c., they had not been ahead. In this matter of aviation they were distinctly behind at the present time, but he did not regard this at the present moment as of very great importance, as he was inclined to think that they could very well make up leeway, and that probably their progress was likely to be of a more solid character, and have the advantage of the earlier experience of their neighbours across the Channel. He did not at the present moment consider that much injury had been done by the delay in making a start, but he was convinced that there was such a growing interest in the whole country that any people who were ready to take the trouble like the Preliminary Committee had in endeavouring to start a club of this kind would have their efforts repaid by the hearty manner in which the people of their own particular district would be ready to respond to the call. Their response and their presence that day showed that there was a sufficiency of interest in that district to enable such a club to be established, and established on a very sound basis. There was one other point which he should like to bring before them at the present moment, and that was that a club of that sort was bound to exercise considerable weight upon public opinion in these matters. As far as Bristol was concerned, they were exceedingly anxious that the city, as capital of the West, should make a prompt move, and that the West of England should join with it in being to the front in promoting a club of this sort, and so embrace the opportunity of acting in co-operation with another body to secure the best possible information of everything which was going on in connection with the science and the development of that science, and to aid such things as were possible, and aid people by encouragement who were prepared to enter upon the promotion and carrying on of aviation in a practical manner.

Sir Geo. White also referred to the factory which was to be started by his firm at Bristol, and after one or two questions had been asked and answered the meeting resolved itself into a committee to draw up rules, &c. It was suggested that the subscription should be two guineas with an entrance fee of a similar amount, but this will not be enforced up to May 30th.

Coventry Aeronautical Society (18 and 19, HERTFORD STREET).

ON Thursday last, a general meeting was held at the Queen's Hotel, Coventry, at 8 p.m., when Mr. A. P. Thurston, B.Sc., gave the second lecture of his series, illustrated by lantern slides. The subjects were (1) "The Propeller and Helicopter"; (2) "Calculations Applied to a Flying Machine."

Mr. Thurston's lectures are of a very practical nature, and of considerable assistance to anyone at present, or likely to be, engaged in the manufacture of a machine.

It is hoped to organise a competition for model machines shortly after the closing of the Aero Show, and that many models exhibited there will be competing. Full particulars of this will be sent later.

Hartlepool's Aero Club (56, WHITLEY STREET, W. HARTLEPOOL).

MANY interesting models were shown at the exhibition at the Black Lion Hotel last week, and after their inspection Messrs. A. Barrett and S. McLeod, the Judges, awarded the first prize to Mr. F. Blackett for his Antoinette-model, a splendid piece of workmanship; second prize to Mr. A. E. Braithwaite, for

a Blériot model; and third prize to Mr. W. Hutton, also or a Blériot model. Two other machines were highly commended, the Blériot monoplane of Mr. G. Hutton, and a clever original design by Messrs. R. McDonald and F. G. Cook. In general all the machines showed marks of original thought, and the competitors are to be congratulated on their productions. Excepting the decision respecting the first prize the Judges averred they had a most difficult task in placing the other machines. The exhibition was well attended by members and their friends, and much satisfaction was expressed at the result of the first practical effort regarding aviation in the Hartlepools.

Irish Aero Club (34, DAWSON STREET, DUBLIN).

At a general meeting held at head-quarters on the 2nd inst., with the Lord Mayor in the chair, it was decided on the suggestion of Mr. John Dunville to start a prize fund for the encouragement of flying in Ireland. It was also suggested that steps should be taken to see what could be done in the way of organising a flying meeting for Ireland. It was decided to leave the question of regulations for the prizes in the hands of the committee.

Midland Aero Club (GRAND HOTEL, BIRMINGHAM).

At the meeting of the club on Wednesday of last week Mr. V. E. Johnson lectured on "Automatic Stability." After detailing the attempts which had been made to secure automatic stability, Mr. Johnson described the essentials necessary in an apparatus for the purpose and gave some particulars regarding a system he had devised. He thought the problem could only be solved on the relay system, and in his scheme he had carefully considered the damping out of all oscillations. For any system to be successful it must be perfectly simple and straightforward, similar in action for both longitudinal and transverse stability, and depend on an absolutely non-variable quantity. When they had a proved, satisfactory system, he believed it would be of immense service to aviation commercially as it would obviate accidents and give confidence.



AVIATION NEWS OF THE WEEK.

Flying at Eastchurch.

ON Thursday of last week three flyers made trips of over 10 miles at Eastchurch, these being the Hon. Maurice Egerton and the Hon. C. S. Rolls, on their Short-Wright machines, and Mr. J. T. C. Moore-Brabazon, on his Short biplane. On Saturday, while the Hon. C. S. Rolls was flying in a strong wind, the motor stopped, but the experience of the aviator was equal to the emergency, and by clever manipulation he was able to glide to a suitable landing place.

A Long Flight by Mr. Ogilvie.

AT Camber Sands, near Rye, on Thursday of last week, Mr. Ogilvie made two splendid flights on his Wright flyer, one of 45 mins. and the other of 26 mins. He also made some good flights on Sunday, one with a passenger.

Van den Born Loses His Way in the Air.

ONE of the most remarkable of the cross-country exploits of aviators in France was that of Van den Born, who on Wednesday of last week flew from Chalons to Rheims for luncheon, the journey taking about 20 mins. The inner man refreshed, the flyer restarted his motor, and after making one or two circles flew off in the direction of Prosnes, where he lost his way. Getting anxious, Mr. Henry Farman sent a message to Chalons Camp, and M. Chavez, another Farman pupil, went up to see if he could find his friend. After rising to a height of 510 metres he descried him in the distance, and by this Van den Born was enabled to recover his way. On his return he said he lost himself among the Rheims hills, and descended at Prosnes, where he obtained directions from a farm labourer. Altogether he covered a distance

Sheffield Aero Club (36, COLVER ROAD, SHEFFIELD).

A WELL-ATTENDED meeting was held on the 2nd inst. at the club's new works. Mr. J. Raby Bramah took the chair, and the chief item on the agenda was the model competitions in connection with Sheffield's Annual Whit Monday Sports Tournament. On the proposal of the Secretary it was decided that the maximum size for models be 3 ft. 6 ins. spread, that there be no distinction between amateur and professional entrants, and that, in addition to ordinary events, a special prize be offered in open class for models rising under their own power, the latter to be of the rubber or spring driven type. A special class for petrol or electrically-propelled machines will also be arranged. Outside competitors will receive every encouragement, and the Committee wish to impress upon, not only the S.A.C. members, but also model enthusiasts throughout the country, that these competitions offer an exceptional opportunity for them to show their ability. Further particulars of events, classes, &c., will be published shortly. The next general meeting will be held at the club's works, 26, Paradise Street, Sheffield, on Wednesday, 16th instant, at 8 p.m.

Women's Aerial League (227, STRAND, W.C.).

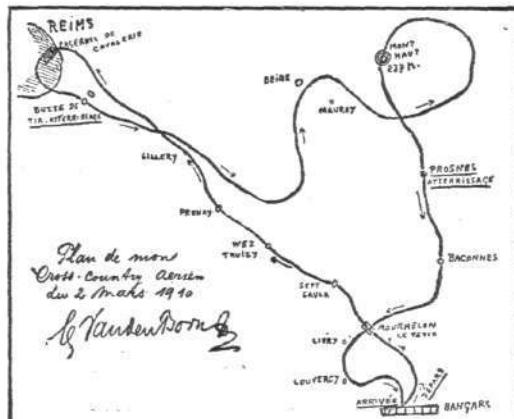
THE second of the series of monthly aerial teas held by the Women's Aerial League took place on March 3rd at the Criterion Restaurant. These meetings, which are in the nature of social gatherings, are instituted for the purpose of bringing the members into constant touch with one another and of arousing interest among their friends. The speaker on March 3rd was Mr. Norman Ewer, who, in the course of a very interesting address, strongly urged the necessity of England attaining the level gained by other nations in aerial progress.

A lecture will be given on April 12th by Miss Gertrude Bacon to the members of the Boys' and Girls' Aerial League, which has lately been formed in connection with the Women's Aerial League.

Mr. Blin Desbelds will also give a Lecture for the League on March 16th.



AVIATION NEWS OF THE WEEK.



Sketch map, from a French contemporary, of the cross-country route taken by M. C. van den Born last week when, flying from Mourmelon, Chalons, to Rheims and back on his Henry Farman biplane, he lost his way in the air, and made the return journey to Mourmelon by the circuitous route shown.

of about 40 miles. Chavez was flying for three-quarters of an hour, and his altitude is the third best on record.

A Military Farman Pupil.

ON the 2nd there was great activity at the Farman school at Chalons, apart from the splendid flights of Van den Born and Chavez. Lieut. Caminerman, one of the military pupils, flew for 1 hr. 6 mins., during which he made excursions over the surrounding country, and once went round the clock tower at Mourmelon. He

ascertained fairly closely by suspending it on a cotton thread, hanging it different ways until the spot is found about which it is always in balance. The centre of pressure can only be ascertained accurately by gliding the model, and it may be necessary to move the centre of gravity in order to get the model to glide at all. When the centre of gravity is so situated that the model remains stable in gliding flight, then the centre of gravity coincides with the centre of pressure.—ED.]

THE ROE TRIPPLANE.

[404] I am much obliged to Mr. Roe for his courteous reply to my queries. It is quite possible that he will be able in the near future to make good his views as to the speed of the triplane, but I do not quite see the analogy he draws with the transmission gear of the motor cars. It would appear to me that so far as the transmission is concerned, the Roe machine is in the same position as most of the others, and the results he has obtained must be due to the superior design of the machine generally.

It is very evident that, as I expected, Mr. Roe has been severely crippled by the excessive weight of his engine, and yet in spite of that he has made a successful man-carrying machine, with, so far as I know, less power than any other designer, and this type of machine will, no doubt, appeal to many users.

The fact that he can carry 50 lbs. per horse-power means that there is so much more margin left to make the machine of a substantial and durable design, and forms a valuable piece of information to those who are still struggling in the experimental stages.

Barnes.

CYLINDER.

SOME OTHER ANSWERS AND QUERIES.

Queries.

Hired Engines.—Mr. S. Gregory, of 16, King Street, Dunscore, near Bolton, wishes to know whether any firm is prepared to hire out a petrol engine for a short period.

British Rotary Engine.—Miss Sheila O'Neill, 1, Gerrard Mansions, Gerrard Street, inquires for names of British makers of rotary motors about 50 h.p.

Inquiry for a Glasgow Accessory Maker.—Mr. Cecil Bond, 453, Victoria Road, Queen's Park, Glasgow, asks for name and address in Glasgow where jointless cane for models can be obtained.

Model Motor Propeller.—Mr. F. Bramley, Leeds, would like to know what kind of motor and what size propeller he requires for a model of a Blériot monoplane. It is constructed of split cane, and is 30 ins. by 30 ins., and the weight is about 3½ ozs. without motor.



MESSRS. CHESHIRE AND ELLIS.—The Olympia Motor Garage, on Addison Bridge, opposite the main entrance to Olympia, are in a position to garage visitors' cars, and, if necessary, supply petrol, oil, grease, &c., or do any repairs that may be required in the shortest possible time.



PUBLICATIONS RECEIVED.

Hydrogen for Aeronautical and Industrial Purposes. By the British Hydrogen Co., 49-50, Parliament Street, S.W.

Flying Machines: Practice and Design. By Rankin Kennedy. London: Technical Publishing Co., Ltd., 55, Chancery Lane. Price, 5s. net.



IMPORTS AND EXPORTS, 1910.

Aeroplanes, airships, balloons and parts thereof (not shown separately before 1910).

Imports.	Exports.	Re-Exportation.
£	£	£
January ... 2,516	January ... 750	January ... 550
February ... 437	February ... 2,950	February ... —
2 months ... 2,953	2 months ... 3,700	2 months ... 550

NEW COMPANY REGISTERED.

Phoenix Radial Rotary Motor Co., Ltd.—Vulcan Works, Quay Street, Gloucester.—Capital £1,000, in £1 shares (900 7 per cent. preferred). Formed to acquire the business of manufacturers of inorganic rheostats and specialists in radial, rotary, and aviation motors carried on by B. D. Scott, F. Barnard, and F. J. Harris-Dodge at Gloucester as the Granville Motor Co. First directors, B. D. Scott, W. Walwin, and F. J. Pope.

DIARY OF FORTHCOMING EVENTS.

British Events.

1910.	1910.	1910.
Mar. 11-12	Flight Exhibition at Olympia.	Aug. 6-13
July 11-12	Bournemouth Flight Meeting.	Flight Meeting, place not fixed.

Foreign Events.

1910.	1910.	1910.
April 2-10	Biarritz.	Rheims to Brussels, cross country event.
April 3-10	Cannes.	July 24-Aug. 10 Belgium.
April 10-25	Nice.	Aug. 25-Sept. 4 Deauville.
May 10-16	Berlin.	Sept. 8-18 Bordeaux.
May 14-22	Lyons.	Sept. 24-Oct. 3 Milan.
May 20-30	Verona.	Oct. 18-25 America. Gordon-Bennett Balloon Race.
June 5-12	Vichy.	Oct. 25-Nov. 2 America. Gordon-Bennett Aeroplane Race.
June 18-24	St. Petersburg.	June 26-July to Rheims.

Aeronautical Patents Published.

Applied for in 1910.

Published March 10th, 1910.

2,397. F. R. SIMMERS.	Aerial machines.
7,503. F. C. HODGES and G. M. SLEBY.	Aerial machines.
12,814. J. SCHÜTTE.	Airships.
19,765. L. A. HAYOT.	Aeroplanes.
22,167. A. BAUMANN.	Airships.

BACK NUMBERS OF "FLIGHT."

SEVERAL back numbers are now very scarce, and have been raised in price as follows:—

No. 2, Jan. 9, containing	Table of Propellers ...	s. d.
3 " 16 "	Engines ...	1 0
4 " 23 "	Engines at Paris Salon ...	3 6
6, Feb. 6 "	" How Men Fly" ...	1 0
	Aeronautical Bibliography.	
8 " 20 "	Wright Bros.' Elevator Patents.	
	Flying Ground at Cambridge	1 0
	Illustrated Glossary.	
10, Mar. 6 "	Human Side of Flying	1 0
	Aero Club Ground at Shellbeach.	
	Military Aeronautics.	
12 " 20 "	Souvenir Supplement ...	1 6
15, Apr. 10 "	Engines at Olympia ...	1 0
16 " 17 "	Prize List ...	3 6
	Models at Olympia.	
31, July 31 "	Blériot Flyer ...	2 0

(Full page drawing.)

Other back numbers, post free, 1½d. each (including descriptions and scale drawings of the Voisin, Curtiss, Cody and Farman biplanes, the Santos Dumont, Antoinette, and Grade monoplanes, and of a full-size Wright glider).

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TITLE PAGE and INDEX for Vol. I, 2d., post free.

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6 " "	3 3	6 " "	5 0
12 " "	12	12 " "	10 0

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